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SOUTHERN SURGICAL ASSOCIATION

VOLUME XXXII

THIRTY-SECOND SESSION

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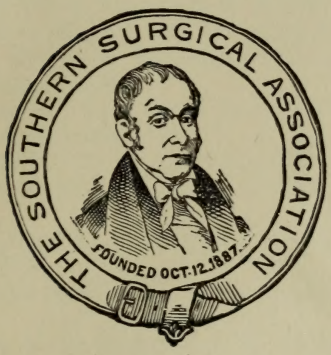

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1920

The Association does not hold itself responsible for the views enunciated in the papers and discussions published in this volume.

H. A. ROYSTER, M.D., *Secretary*,
RALEIGH, N. C.

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PHILADELPHIA

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OFFICERS FOR 1919–1920

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C. JEFF MILLER, New Orleans, La.

EDWARD G. JONES, Atlanta, Ga.

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ISAAC S. STONE, Washington, D. C.

JAMES E. THOMPSON, Galveston, Texas.

LIST OF OFFICERS

FROM THE ORGANIZATION TO THE PRESENT TIME.

* Deceased.

	President	*Vice-Presidents*	*Secretary*	*Treasurer*
1888.	*W. D. Haggard	R. D. Webb J. W. Sears	*W. E. B. Davis	Hardin P. Cochrane
1889.	*Hunter H. McGuire	W. O. Roberts *Bedford Brown	*W. E. B. Davis	Hardin P. Cochrane
1890.	*George J. Engelmann	*Berthold E. Hadra Duncan Eve	*W. E. B. Davis	Hardin P. Cochrane
1891.	Lewis S. McMurtry	*J. McFadden Gaston J. T. Wilson	*W. E. B. Davis	Hardin P. Cochrane
1892.	*J. McFadden Gaston	*Cornelius Kollock *George Ben Johnston	*W. E. B. Davis	Hardin P. Cochrane
1893.	*Bedford Brown	*Joseph Price George A. Baxter	*W. E. B. Davis	Hardin P. Cochrane
1894.	*Cornelius Kollock	A. B. Miles J. B. S. Holmes	*W. E. B. Davis	Hardin P. Cochrane
1895.	*Louis McLane Tiffany	Ernest S. Lewis *Manning Simons	*W. E. B. Davis	*Richard Douglas
1896.	Ernest S. Lewis	Joseph Taber Johnson *Richard Douglas	*W. E. B. Davis	*A. M. Cartledge
1897.	*George Ben Johnston	W. E. Parker Floyd W. McRae	*W. E. B. Davis	*A. M. Cartledge
1898.	*Richard Douglas	*H. H. Mudd *James A. Goggans	*W. E. B. Davis	*A. M. Cartledge
1899.	Joseph Taber Johnson	F. W. Parham *W. L. Robinson	*W. E. B. Davis	*A. M. Cartledge
1900.	*A. M. Cartledge	*Manning Simons W. P. Nicolson	*W. E. B. Davis	W. D. Haggard
1901.	*Manning Simons	George H. Noble L. C. Bosher	W. D. Haggard	Floyd W. McRae
1902.	*W. E. B. Davis	J. Wesley Bovée J. W. Long	W. D. Haggard	Floyd W. McRae
1903.	J. Wesley Bovée	Christopher Tompkins Bacon Saunders	W. D. Haggard	Floyd W. McRae
1904.	Floyd W. McRae	*George S. Brown J. Shelton Horsley	W. D. Haggard	Charles M. Rosser
1905.	Lewis C. Bosher	J. D. S. Davis I. S. Stone	W. D. Haggard	Charles M. Rosser
1906.	George H. Noble	Stuart McGuire E. Denegre Martin	W. D. Haggard	Charles M. Rosser
1907.	Howard A. Kelly	Rufus E. Fort Hubert A. Royster	W. D. Haggard	Charles M. Rosser
1908.	F. W. Parham	*Henry D. Fry W. F. Westmoreland	W. D. Haggard	Stuart McGuire
1909.	Stuart McGuire	*John Young Brown R. S. Cathcart	W. D. Haggard	Wm. S. Goldsmith
1910.	W. O. Roberts	Joseph C. Bloodgood Lewis C. Morris	W. D. Haggard	Wm. S. Goldsmith
1911.	Rudolph Matas	Guy L. Hunner J. Garland Sherrill	W. D. Haggard	Wm. S. Goldsmith
1912.	J. M. T. Finney	J. E. Thompson W. P. Carr	W. D. Haggard	Wm. S. Goldsmith
1913.	*John Young Brown	*Ap Morgan Vance Lomax Gwathmey	W. D. Haggard	Le Grand Guerry
1914.	John W. Long	A. C. Scott James F. Mitchell	W. D. Haggard	Le Grand Guerry
1915.	Bacon Saunders	Thomas S. Cullen S. M. D. Clark	W. D. Haggard	Le Grand Guerry
1916.	Thomas S. Cullen	Robert S. Hill Willard Bartlett	W. D. Haggard	Le Grand Guerry
1917.	W. D. Haggard	J. Ernest Stokes F. R. Hagner	H. A. Royster	Le Grand Guerry
1918.	Isaac S. Stone	Le Grand Guerry Carey P. Rogers	H. A. Royster	Guy L. Hunner
1919.	James E. Thompson	Charles R. Robins George A. Hendon	H. A. Royster	Guy L. Hunner
1920.	Willard Bartlett	C. Jeff Miller Edward G. Jones	H. A. Royster	Guy L. Hunner

LIST OF MEETING PLACES, WITH DATES AND PRESIDING OFFICERS

1888.	Birmingham,	William D. Haggard
1889.	Nashville,	Hunter H. McGuire
1890.	Atlanta,	George J. Engelmann
1891.	Richmond,	Lewis S. McMurtry
1892.	Louisville,	J. McFadden Gaston
1893.	New Orleans,	Bedford Brown
1894.	Charleston,	Cornelius Kollock
1895.	Washington,	Louis McLane Tiffany
1896.	Nashville,	Ernest S. Lewis
1897.	St. Louis,	George Ben Johnston
1898.	Memphis,	Richard Douglas
1899.	New Orleans,	Joseph Taber Johnson
1900.	Atlanta,	A. M. Cartledge
1901.	Richmond,	Manning Simons
1902.	Cincinnati,	W. E. B. Davis
1903.	Atlanta,	J. Wesley Bovée
1904.	Birmingham,	Floyd W. McRae
1905.	Louisville,	Lewis C. Bosher
1906.	Baltimore,	George H. Noble
1907.	New Orleans,	Howard A. Kelly
1908.	St. Louis,	F. W. Parham
1909.	Hot Springs,	Stuart McGuire
1910.	Nashville,	William O. Roberts
1911.	Washington,	Rudolph Matas
1912.	Old Point,	John M. T. Finney
1913.	Atlanta,	John Young Brown
1914.	Asheville,	John W. Long
1915.	Cincinnati,	Bacon Saunders
1916.	White Sulphur Springs,	Thomas S. Cullen
1917.	St. Augustine,	William D. Haggard
1918.	Baltimore,	Isaac S. Stone
1919.	New Orleans,	James E. Thompson

HONORARY FELLOWS

Founder.—Cunningham, Russell M.	Ensley, Ala.
Founder.—Davis, John D. S.	Birmingham, Ala.
1894.—Foy, George	Dublin.
Founder.—*Goggans, James A.	Alexander City, Ala.
1894.—Jacobs, Charles	Brussels.
1914.—Johnson, Joseph Taber	Cherrydale, Va.
1910.—Jones, Robert	Liverpool.
1910.—Lane, Arbuthnot	London.
1917.—Lewis, Ernest S.	New Orleans, La.
Founder.—Long, John Wesley	Greensboro N. C.
1917.—McMurtry, Lewis S.	Louisville, Ky.
1894.—Martin, A.	Berlin.
1902.—Maury, Richard B.	Memphis, Tenn.
1894.—Morisani, O.	Naples.
1910.—Morison, Rutherford	New-Castle-on-Tyne.
1910.—Moynihan, B. G. A.	Leeds.
1910.—Myles, Thomas, Sir	Dublin.
1894.—*Pozzi, S.	Paris.
1910.—Robson, Mayo	London.
Founder.—*Schilling, Nicholas	Cedar Bayou, Texas.
1910.—Stiles, H. J.	Edinburgh.
Founder.—Stone, Isaac S.	Washington, D. C.
Founder.—Taylor, Hugh M.	Richmond, Va.
1917.—Tuholske, Herman	St. Louis, Mo.

* Deceased

FELLOWS

1908.—Abell, Irvin, M.D. Professor of Principles and Practice of Surgery and Clinical Surgery, Medical Department, University of Louisville; Visiting Surgeon, University Hospital, Louisville City Hospital, and St. Mary and Elizabeth Hospital. 1228 Second St., Louisville, Ky.

1911.—Allen, Carroll W., M.D. 1312 Louisiana Ave., New Orleans, La.

1915.—Baer, William Stevenson, F.A.C.S., A.B., M.D. Associate Professor, Orthopedic Surgery, Johns Hopkins University; Associate in Orthopedic Surgery in charge of Orthopedic Department, Johns Hopkins Hospital; Consulting Orthopedic Surgeon, Home for Incurables; Surgeon-in-chief, Children's Hospital; Visiting Orthopedic Surgeon, Union Protestant Infirmary, Hospital for Women of Maryland, and Robert Garrett Hospital for Children; Consulting Orthopedic Surgeon, Cambridge Hospital, Cambridge, Md. 4 West Madison Street, Baltimore, Md.

1917.—Bagley, Charles, Jr., A.B., M.D. Associate in Experimental Neurology Johns Hopkins University. 5 West Chase Street, Baltimore, Md.

1914.—Bailey, Fred. Warren, B.Sc., M.D. Assistant Professor of Surgery, St. Louis University School of Medicine; Associate Chief Surgeon, St. John's Hospital; Visiting Gynecologist, St. Louis City Sanitarium. 633 Metropolitan Building, St. Louis, Mo.

1905.—Baker, James Norment, M.D. Visiting Surgeon, St. Margaret's Hospital; Secretary of the Medical Association of the State of Alabama. 719 Madison Avenue, Montgomery, Alabama.

1916.—Balfour, Donald Church, M.D. Surgeon to St. Mary's Hospital. Rochester, Minn.

1903.—Balloch, Edward A., M.D. Professor of Surgery, Medical Department of Howard University; Surgeon to Freed-

men's Hospital; Member American Academy of Medicine. 1511 Rhode Island Avenue, N. W., Washington, D. C.

1916.—Barksdale, John W., M.D. Winona, Miss.

1908.—Barr, Richard Alexander, M.D. Professor of Surgery and Clinical Surgery, Medical Department of Vanderbilt University; late Major of First Tennessee Infantry, U. S. A. First National Bank Building, Nashville, Tenn.

1905.—Barrow, David, M.D. Ex-President Kentucky State Medical Society. 148 Market Street, Lexington, Ky.

1905.—Bartlett, Willard, M.D. Surgeon to St. Anthony's Hospital. *Vice-President*, 1916. 4257 Washington Boulevard, St. Louis, Mo.

1901.—Baughman, Greer, M.D. Professor of Obstetrics, Medical College of Virginia; Visiting Obstetrician to the Virginia Hospital, Memorial Hospital, and Stuart Circle Hospital, Richmond, Virginia. 26 North Laurel Street.

1917.—Bell, Richard Phillip, B.A., M.D. Member of Staff, King's Daughters Hospital. Masonic Building, Staunton, Va.

1916.—Biggs, Montgomery Herman, M.D. Surgeon to Rutherford Hospital; Chief Surgeon C. C. and O. Railway. Rutherfordton, N. C.

1916.—Black, William T., M.D. Exchange Building, Memphis, Tenn.

1908.—Blair, Vilray Papin, A.M., M.D. Metropolitan Building, St. Louis, Mo.

1906.—Bloodgood, Joseph Colt, M.D. Associate Professor of Surgery, Johns Hopkins University; Associate Surgeon, Johns Hopkins Hospital; Surgeon to the Union Protestant Infirmary; Chief Surgeon to St. Agnes' Hospital. *Vice-President*, 1910. 904 North Charles Street, Baltimore, Md.

1901.—Boldt, Hermann J., M.D. Gynecologist to Post-Graduate Hospital, St. Mark's Hospital, German Polyclinic; Consulting Gynecologist to the Beth Israel Hospital and to St. Vincent's Hospital; Professor of Gynecology, Post-Graduate Medical School; Member of the Gynecological Society of Germany; Fellow of the American Gynecological Society; Fellow of the Royal Society of Medicine (London); ex-President of the New York Obstetrical Society; of the German Medical Society of New York; of the Section of

Obstetrics of the New York Academy of Medicine. 39 East Sixty-first Street, New York, N. Y.

1902.—Bonifield, Charles Lybrand, M.D. Professor of Clinical Gynecology, Medical College of Ohio (Medical Department University of Cincinnati); Member American Association of Obstetricians and Gynecologists; ex-President, Cincinnati Academy of Medicine; ex-President, Cincinnati Obstetrical Society. 409 Broadway, Cincinnati, Ohio.

1890.—Bosher, Lewis Crenshaw, M.D. Professor of Practice of Surgery and Clinical Surgery in the Medical College of Virginia; Visiting Surgeon to the Memorial Hospital; Member of American Surgical Association; Member of the American Association of Obstetricians and Gynecologists; Member of Association of American Anatomists; Member of American Urological Association; ex-President of Richmond Academy of Medicine and Surgery. *Vice-President,* 1901; *President,* 1905. 422 East Franklin Street, Richmond, Va.

1895.—Bovée, J. Wesley, M.D. Fellow of American Gynecological Society; President of Washington Obstetrical and Gynecological Society; ex-President Medical and Surgical Society of the District of Columbia; Honorary Fellow of Medical Society of Virginia; Professor of Gynecology of George Washington University, Washington, D. C.; Gynecologist to Providence, Columbia, and George Washington University Hospitals; Consulting Physician to St. Ann's Infant Asylum, and Attending Gynecologist to St. Elizabeth's Hospital for the Insane, Washington, D. C. *Vice-President,* 1902; *President,* 1903; Member of *Council,* 1903–1906. The Rochambeau, Washington, D. C.

1908.—Bryan, Robert C., M.D. Professor of Genito-urinary Diseases, Medical College of Virginia; Visiting Surgeon to the Virginia Hospital. First and Main Streets, Richmond, Virginia.

1910.—Bryan, W. A., M.D. Professor of Surgery and Clinical Surgery, Vanderbilt University; Professor of Oral Surgery, Dental Department, Vanderbilt University. 146 Eighth Avenue, N., Nashville, Tenn.

1913.—Buist, A. Johnston, M.D. Professor of Gynecology, Medical College of the State of South Carolina; Visiting Gynecologist, Roper Hospital. 279 Meeting Street, Charleston, S. C.

1907.—Burch, Lucius E., M.D. Professor of Gynecology, Vanderbilt University, Medical Department; Gynecologist, Nashville City Hospital; Captain and Surgeon, N. G. S. T. 706 Church Street, Nashville, Tenn.

1917.—Burnam, Curtis Field, A.B., M.D. Surgeon, Howard A. Kelly Hospital. 1418 Eutaw Place, Baltimore, Md.

1902.—Caldwell, C. E., A.M., M.D. Clinical Professor of Surgery and Associate Professor of Surgical Anatomy in Medical Department, University of Cincinnati; Surgeon to Cincinnati General Hospital. "The Livingstone," Seventh and Race Streets, Cincinnati, Ohio.

1910.—Caldwell, Robert, M.D. Professor of Surgical Anatomy, Vanderbilt University; ex-President of Nashville Academy of Medicine. 315 Jackson Building, Nashville, Tenn.

1906.—Cannaday, John Egerton, M.D. Former Surgeon-in-Charge to Sheltering Arms Hospital, Hansford, W. Va.; Fellow of the American Association of Obstetricians and Gynecologists; Non-resident Honorary Fellow of the Kentucky State Medical Society; Fellow of the West Virginia Medical Association, Virginia Medical Society, Tri-State Society of Virginia and the Carolinas, American Association of Railway Surgeons. 100 Capitol Street, Charleston, W. Va.

1904.—Carothers, Robert, M.D. Professor of Clinical Surgery, Medical College of Ohio, Medical Department, Cincinnati University; Surgeon to the Good Samaritan Hospital; 413 Broadway, Cincinnati, Ohio.

1903.—Carr, William P., M.D. Professor of Physiology and Professor of Clinical Surgery, Columbian University; Surgeon to the Emergency Hospital and University Hospital; Consulting Surgeon to the Washington Asylum Hospital and the Goverment Hospital for the Insane, Washington, D. C. *Vice-President*, 1912. 1418 L Street, N. W., Washington, D. C.

1899.—Cathcart, R. S., M.D. Professor of Abdominal Surgery, Medical College of the State of South Carolina; Surgeon-in-chief, Roper Hospital, Charleston, S. C.; Surgeon, Atlantic Coast Line Railway, Charleston Consolidated Railway and Lighting Co., The Citadel—the Military College of South Carolina, and the Confederate Home College, Charleston, S. C. *Vice-President*, 1909. 66 Hasell Street, Charleston, South Carolina.

1907.—Clark, John G., M.D. Professor of Gynecology, University of Pennsylvania; Gynecologist-in-Chief, University Hospital. 2017 Walnut Street, Philadelphia, Penna.

1907.—Clark, S. M. D., M.D. Professor of Gynecology and Clinical Obstetrics, Tulane Medical Department; Visiting Surgeon, Charity Hospital. 1435 Harmony Street, New Orleans, Louisiana.

1919.—Clopton, Malvern Bryan, M.D. Associate in Surgery, Washington University Medical School; Visiting Surgeon, St. Luke's Hospital; Associate Surgeon, Barnes Hospital and Children's Hospital. Humboldt Building, St. Louis, Missouri.

1893.—Cocram, Henry S., M.D. 108 Baronne Street, New Orleans, La.

1908.—Coffey, Robert C., M.D. Secretary, Oregon State Board of Medical Examiners; Councillor, Oregon State Medical Association. Stevens Building, Portland, Oregon.

1909.—Cole, Herbert Phalon, M.D. Instructor in Gynecology and Clinical Diagnosis, Medical Department of the University of Alabama; Gynecologist to City Hospital of Mobile. 202 Conti Street, Mobile, Ala.

1916.—Coleman, Claude C., M.D. Professor of Oral Surgery and Anesthesia, Associate in Clinical Surgery, Medical College of Virginia; Attending Surgeon to Memorial and Virginia Hospitals. 200 W. Grace Street, Richmond, Va.

1902.—Coley, William B., M.D. Clinical Lecturer on Surgery, College of Physicians and Surgeons; Assistant Surgeon in Hospital for Ruptured and Crippled; Attending Surgeon to General Memorial Hospital; Fellow of the American Surgical Association, New York Surgical Society, and New York Academy of Medicine. 40 East Forty-first Street, New York, N. Y.

1914.—Cousins, William Lewis, M.D. Surgeon-in-Chief, St. Barnabas' Hospital; Consulting Surgeon, Maine General Hospital. 231 Woodford Street, Portland, Maine.

1916.—Cowden, Charles N., M.D. Surgeon to City Hospital; Gynecologist to St. Thomas' Hospital. Hitchcock Bldg., Nashville, Tenn.

1907.—Crawford, Walter W., M.D. Ex-President Southern Medical Association; ex-President Perry County Medical Society; ex-President Mississippi State Medical

Association; Surgeon to South Mississippi Infirmary. Hattiesburg, Miss.

1902.—Crile, George W., M.D. Professor of Surgery, The School of Medicine of Western Reserve University; Visiting Surgeon to Lakeside Hospital. 1021 Prospect Avenue, Cleveland, Ohio.

1908.—Crisler, Joseph Augustus, M.D. Professor of Anatomy and Operative Surgery, College of Physicians and Surgeons, Memphis, Tennessee; Lecturer on Minor Surgery, Medical Department, University of Mississippi; ex-Member of Mississippi State Board of Health and Medical Examiners; ex-Vice-President Mississippi State Medical Association and Tri-State Medical Association. Memphis Trust Building, Memphis, Tenn.

1917.—Cullen, Ernest K., M.B. Assistant Professor of Gynecology, Detroit College of Medicine and Surgery; Associate Surgeon in Gynecology, Harper Hospital. David Whitney Building, Detroit, Mich.

1906.—Cullen, Thomas Stephen, M.B. Associate Professor of Gynecology, Johns Hopkins University; Associate in Gynecology, Johns Hopkins Hospital; Consultant in Abdominal Surgery, Church Home and Infirmary. Fellow of the American Gynecological Society; Honorary Member to La Societa Italiana Ostettricia Ginecologia, Rome; Corresponding Member of the Gesellschaft f. Geburtshülfe, Leipzig. *Vice-President,* 1915; *President,* 1916. 20 E. Eager Street, Baltimore, Maryland.

1907.—Danna, Joseph A., M.D. Chief Visiting Surgeon, Charity Hospital. Charity Hospital, New Orleans, Louisiana.

1910.—Davis, John Staige, M.D. Instructor in Surgery, Johns Hopkins University; Assistant Surgeon to the Out-Patient Department of Johns Hopkins Hospital; Visiting Surgeon to the Union Protestant Infirmary, Visiting Surgeon to the Church Home and Infirmary. 1200 Cathedral Street, Baltimore, Md.

1900.—Deaver, John B., M.D. Surgeon-in-Chief to the Lankenau Hospital. 1634 Walnut Street, Philadelphia.

1896.—Doughty, W. H., M.D. Professor of Special Surgery and Surgical Pathology, Medical Department, University of Georgia; Chief Surgeon to Charleston and Western Carolina Railroad. 822 Greene Street, Augusta, Ga.

1914.—Downes, William Augustus, M.D. Assistant Professor of Clinical Surgery, Columbia University, College of Physicians and Surgeons; Attending Surgeon, General Memorial and Babies' Hospitals; Associate Attending Surgeon, St. Luke's Hospital and Hospital for Ruptured and Crippled. 37 West Seventy-first Street, New York, N. Y.

1916.—Du Bose, Francis Goodwin, M.D. Surgeon-in-Charge of Vaughan Memorial Hospital. Selma, Ala.

1890.—Earnest, John G., M.D. Professor of Clinical Gynecology, College of Physicians and Surgeons; formerly Professor of Gynecology, Southern Medical College; Visiting Gynecologist to the Grady Hospital. 828 Candler Building, Atlanta, Ga.

1907.—Elbrecht, Oscar Herman, M.D. Visiting Surgeon, St. Louis City Hospital; Consulting Surgeon to St. Louis Maternity, Bethesda and Missouri Pacific Railroad Hospitals. 423 Metropolitan Building, St. Louis, Mo.

1891.—Elkin, William Simpson, M.D. Professor of Operative and Clinical Surgery, Atlanta College of Physicians and Surgeons; ex-President of the Atlanta Society of Medicine; Surgeon to Grady Hospital. 27 Luckie St., Atlanta, Ga.

1904.—Finney, J. M. T., M.D. Associate Professor of Surgery, Johns Hopkins University; Surgeon to Out-patients, Johns Hopkins Hospital. *President*, 1912. 1300 Eutaw Place, Baltimore, Md.

1917.—Fletcher, Marshall H., M.D. Chief of Staff, Asheville Mission Hospital; Surgeon Clarence Barker Memorial Hospital and Dispensary, Biltmore. 17 Church Street, Asheville, N. C.

1901.—Fort, Rufus E., M.D. Chief Surgeon, Nashville Terminal Company; Surgeon to Tennessee Central Railroad; Surgeon to Nashville Hospital; *Vice-President*, 1907. 209 Seventh Avenue, N., Nashville, Tenn.

1905.—Frank, Louis, M.D. Professor of Surgery and Clinical Surgery, University of Louisville; Visiting Surgeon to Louisville City Hospital. 400 Atherton Building, Louisville, Ky.

1916.—Frazier, Charles H., M.D. Professor of Clinical Surgery, University of Pennsylvania. 1724 Spruce Street, Philadelphia, Pa.

1902.—Freiberg, Albert H., M.D., L.L.D., Professor of Orthopedic Surgery in the University of Cincinnati; Orthopedic Surgeon to the Cincinnati Hospital and to the Jewish Hospital of Cincinnati. Livingstone Building, Cincinnati, Ohio.

1917.—Gerster, John C. A., M.D. Instructor in Operative Surgery, Cornell University Medical College. 34 East 75th St., New York, N. Y.

1917.—Gessner, Hermann B., A.M., M.D. Professor of Operative and Clinical Surgery in Tulane University; Chief Visiting Surgeon to Charity Hospital; Junior Surgeon to Touro Infirmary. 1105 Maison Blanche, New Orleans, La.

1913.—Gibbon, Robert, L., M.D. Charlotte, N. C.

1918.—Gilcreest, Edgar L., A.B., M.D. 3698 California St., San Francisco, Cal.

1900.—Goldsmith, W. S., M.D. *Treasurer*, 1909–1912. 262 Jackson Street, Atlanta, Ga.

1892.—Grant, Horace H., M.D. Professor of Surgery in the Hospital College of Medicine; Surgeon to the Louisville City Hospital. 328 Atherton Building, Louisville, Ky.

1905.—Guerry, Le Grand, M.D. Surgeon, Columbia Hospital. *Treasurer*, 1913–1918. *Vice-President*, 1918. Columbia, S. C.

1896.—Gwathmey, Lomax, M.D. Attending Gynecologist to St. Vincent's Hospital and Dispensary, *Vice-President*, 1913. Norfolk, Va.

1896.—Haggard, William David, M.D. Professor of Surgery and Clinical Surgery, Vanderbilt University. Surgeon to St. Thomas' Hospital, Vanderbilt and City Hospitals. *Treasurer*, 1900; *Secretary*, 1901–1916; *President*, 1917. 706 Church Street, Nashville, Tenn.

1910.—Hagner, Francis Randall, M.D. Professor of Genito-urinary Surgery, George Washington University; Attending Genito-urinary Surgeon, George Washington University Hospital; Attending Surgeon, Garfield Memorial Hospital. *Vice-President*, 1917. The Farragut, Washington, D. C.

1892.—Hall, Rufus Bartlett, A.M., M.D. Professor of Clinical Gynecology in the Miami Medical College; Gynecologist to the Presbyterian Hospital; ex-President of the Cincinnati Obstetrical Society; ex-President of the American Association of Obstetricians and Gynecologists; Fellow of British Gynecological Society. 628 Elm Street, Cincinnati, O.

1910.—Hanes, Granville S., M.D. Professor of Surgery of the Rectum and Intestinal Diseases, Medical Department of the University of Louisville; Surgeon to the Louisville City Hospital. The Atherton Building, Louisville, Ky.

1896.—Heflin, Wyatt, M.D. Ex-President of the Jefferson County Medical Society. Birmingham, Ala.

1917.—Helms, John Sullivan, A.B., M.D. Chief Surgeon, Tampa Children's Home; Associate Surgeon, Gordon Keller Memorial and Woman's Hospitals. Tampa, Fla.

1905.—Hendon, George A., M.D. Professor of Surgery and Clinical Surgery, University of Louisville. *Vice-President.* 968 Baxter Avenue, Louisville, Ky.

1918.—Henson, James W., M.D. Associate Professor of Surgery, Medical College of Virginia; Member of Surgical Staff of Virginia and Memorial Hospitals; Surgeon to the Southern Railway. 405 N. Allen Avenue, Richmond, Va.

1889.—Hill, Robert Somerville, M.D. Gynecologist to the Laurel Hill Hospital; Senior Councillor of the Medical Association of the State of Alabama; ex-President of the Montgomery County Medical and Surgical Association; former Surgeon of the Second Regiment, Alabama State Militia. *Vice-President,* 1916. Montgomery, Ala.

1913.—Hodgson, Fred G., M.D. Assistant in Orthopedics, Atlanta Medical College; Orthopedic Surgeon, Wesley Memorial Hospital and MacVicar Hospital of Spelman Seminary; Junior Orthopedic Surgeon, Grady Memorial Hospital. 72 West Peachtree Street, Atlanta, Ga.

1911.—Hogan, Edgar P., M.D. Associate Professor of Gynecology and Abdominal Surgery, Graduate School of Medicine of the University of Alabama; Resident Surgeon and Gynecologist to the Hillman Hospital. 412–14 Empire Building, Birmingham, Ala.

1906.—Holden, Gerry R., M.D. Formerly House Surgeon, Roosevelt Hospital, New York City; formerly Resident Gynecologist, Johns Hopkins Hospital, and Assistant in Gynecology, Johns Hopkins Medical School. 223 West Forsyth Street, Jacksonville, Fla.

1900.—Horsley, John Shelton, M.D. Surgeon-in-Charge, St. Elizabeth's Hospital. *Vice-President,* 1904. 617 West Grace Street, Richmond, Va.

1903.—Hunner, Guy Le Roy, M.D. Associate in Gynecology, Johns Hopkins University; Professor of Genito-urinary Surgery, Woman's Medical College of Baltimore; Gynecologist-in-Chief, St. Agnes' Hospital; Visiting Gynecologist, Church Home and Hebrew Hospital, Baltimore, Frederick City Hospital, Frederick, Md., and Hagerstown Hospital, Hagerstown, Md.; Consulting Gynecologist, Brattleboro Memorial Hospital, Brattleboro, Vt. *Vice-President*, 1911. *Treasurer*. 2305 St. Paul Street, Baltimore, Md.

1900.—Ill, Edward Joseph, M.D. Surgeon to the Woman's Hospital; Medical Director, St. Michael's Hospital; Gynecologist and Supervising Obstetrician, St. Barnabas' Hospital; Consulting Gynecologist to German Hospital and Beth Israel Hospital of Newark, N. J., to All Souls' Hospital, Morristown, N. J., and to Mountain Side Hospital, Montclair, N. J.; Vice-President from New Jersey to Pan-American Congress of 1893. 1002 Broad Street, Newark, N. J.

1912.—Jackson, William R., M.D. Professor of Surgery to the Medical Department of the University of Alabama; Consulting Surgeon to the City Hospital and Southern Infirmary, Mobile, Ala. 164 St. Michael Street, Mobile, Ala.

1908.—Jonas, Ernst, M.D. Clinical Professor of Surgery, Medical Department, Washington University; Chief of Surgical Clinic, Washington University Hospital; Gynecologist to the Jewish Hospital; Surgeon to the Martha Parsons Hospital for Children; Fellow of the American Association of Obstetricians and Gynecologists. 4495 Westminster Place, St. Louis, Missouri.

1910.—Jones, Edward Groves, A.B., M.D. Professor of Surgery, Medical Department, Emory University (Atlanta Medical College); Surgeon to Grady Memorial Hospital, Georgia Baptist Hospital and Wesley Memorial Hospital. 714 Hurt Building, Atlanta, Ga.

1902.—Jordan, William Mudd, M.D. 501 Woodward Building, Birmingham, Ala.

1912.—Judd, Edward Starr, M.D. Surgeon to St. Mary's Hospital, Rochester, Minn.

1890.—Kelly, Howard Atwood, M.D. Founder of Kensington Hospital, Philadelphia; Associate Professor of Obstetrics, University of Pennsylvania, 1888–89; Professor of Gynecology

and Obstetrics, Johns Hopkins University, 1889–99; Professor of Gynecology, Johns Hopkins University; Gynecologist-in-Chief to Johns Hopkins Hospital; Membre Associé Etranger de la Société Obstétricale et Gynécologique de Paris; Correspondirendes Mitglied der Gesellschaft f. Geburtshülfe zu Leipzig; Honorary Fellow, Edinburgh Obstetrical Society, Royal Academy of Medicine (Ireland), and British Gynecological Society; Member of Washington Academy of Sciences; Fellow of the American Gynecological Society. *President*, 1907. 1418 Eutaw Place, Baltimore, Maryland.

1917.—Kerr, Harry Hyland, M.D., C.M. Clinical Professor of Surgery, George Washington University Medical School; Attending Surgeon Garfield Memorial and Children's Hospitals; Associate Surgeon, Providence Hospital. 1742 N. St., N. W., Washington, D. C.

1907.—Kirchner, Walter C. G., M.D. Formerly Surgeon-in-Charge, St. Louis City Hospital. 508 Metropolitan Building, St. Louis, Mo.

1899.—Kohlman, William, M.D. 3500 Prytania Street, New Orleans, La.

1913.—LaRoque, G. Paul, M.D. Associate Professor of Surgery, Medical College of Virginia; Surgeon, Memorial Hospital. 501 East Grace Street, Richmond, Va.

1914.—Landry, Lucian, M.D. Assistant Demonstrator in Operative Surgery and Instructor in Clinical Surgery, Tulane University of Louisiana, School of Medicine; Junior Surgeon, Touro Infirmary; Visiting Surgeon, Charity Hospital. 2255 St. Charles Avenue, New Orleans, La.

1916.—Law, Arthur Ayer, M.D. Associate Professor of Surgery, University of Minnesota Medical School and Mayo Foundation; Major, M. O. R. C. and Director, University of Minnesota Base Hospital, No. 26; Surgeon, University of Minnesota Hospital and University Hospital; Assistant Chief of University Hospital. Syndicate Building, Minneapolis, Minn.

1917.—Ledbetter, Samuel L., Jr., M.D. First National Bank Building, Birmingham, Ala.

1894.—Leigh, Southgate, M.D. Visiting Surgeon to St. Vincent's and Norfolk Protestant Hospitals; First Vice-President of Medical Society of Virginia, 1899-1900. 147 Granby Street, Norfolk.

1912.—Lewis, Bransford, M.D. Century Building, St. Louis, Mo.

1914.—Lewis, Dean, A.B., M.D. Associate Professor of Surgery, Rush Medical College; Attending Surgeon, Presbyterian Hospital; Consulting Surgeon, Anne W. Durand Hospital of the Memorial Institute for Infectious Diseases. 122 South Michigan Avenue, Chicago, Ill.

1900.—Lloyd, Samuel, M.D. Professor of Surgery, New York Post-Graduate Medical School; Attending Surgeon to the Post-Graduate Hospital and St. Francis' Hospital, and Consulting Surgeon to the Benedictine Sanitarium at Kingston, N. Y. 15 East Forty-second St., New York, N. Y.

1904.—Lupton, Frank A., M.D. 816 Woodward Building, Birmingham, Ala.

1902.—McAdory, Wellington P., M.D. Surgeon to Hillman Hospital. Birmingham, Ala.

1911.—McGlannan, Alexius, M.D. Associate Professor of Surgery, College of Physicians and Surgeons, Baltimore. 114 West Franklin St., Baltimore, Md.

1893.—McGuire, Stuart, M.D. Professor of the Principles of Surgery and Clinical Surgery, University College of Medicine; Surgeon-in-Charge, St. Luke's Hospital; Visiting Surgeon, Virginia Hospital; Consulting Surgeon, Virginia Home for Incurables. *Vice-President*, 1906; *Treasurer*, 1908; *President*, 1909. 518 East Grace Street, Richmond, Va.

1891.—McGuire, W. Edward, M.D. Professor of Gynecology, University College of Medicine; Gynecologist to the Virginia Hospital. 411 East Grace Street, Richmond, Va.

1888.—McRae, Floyd Wilcox, M.D. Professor of Gastro-intestinal, Rectal, and Clinical Surgery, Atlanta College of Physicians and Surgeons; Surgeon to Grady Hospital; ex-President Medical Association of Georgia; ex-Secretary of Section on Surgery and Anatomy, American Medical Association. *Vice-President*, 1897; *Treasurer*, 1901–1903; *President*, 1904. Peters Building, Atlanta, Ga.

1905.—MacLean, Henry Stuart, M.D. Professor of Pathology, University College of Medicine. 406 West Grace Street, Richmond, Va.

1915.—Maes, Urban, M.D. Assistant Professor of Clinical and Operative Surgery, Tulane University of Louisiana School

of Medicine; Junior Surgeon, Charity Hospital and Touro Infirmary; Senior Surgeon, New Orleans Dispensary for Women and Children. 1671 Octavia Street, New Orleans, Louisiana.

1912.—Malone, Battle, M.D. 1701 Exchange Building, Memphis, Tenn.

1891.—Marcy, Henry Orlando, M.D., LL.D. Ex-President of the American Medical Association; President of the Section of Gynecology, Ninth International Medical Congress, late President of the American Academy of Medicine; Corresponding Member of the Medico-Chirurgical Society of Bologna, Italy; Fellow of the American Association of Obstetricians and Gynecologists. 180 Commonwealth Avenue, Boston, Mass.

1899.—Martin, E. Denegre, M.D. Professor of Surgery, Post-Graduate Department, Tulane Medical College; Visiting Surgeon to Charity Hospital. *Vice-President*, 1906. 741 Carondelet St., New Orleans, La.

1909.—Martin, Frank, M.D. Clinical Professor of Surgery at the University of Maryland. 1000 Cathedral Street, Baltimore, Md.

1913.—Martin, Franklin H., M.D. Professor of Gynecology, Post-Graduate School; Consulting Staff, St. Luke's Hospital. Editor, *Surgery, Gynecology and Obstetrics*. 30 North Michigan Avenue, Chicago, Ill.

1904.—Mason, J. M., M.D. Gynecologist to St. Vincent's Hospital. 1915 Sixteenth Avenue, S., Birmingham, Ala.

1899.—Mastin, William M., M.D. Fellow of the American Surgical Association; Member of the American Association of Genito-urinary Surgeons; Surgeon to the Mobile City Hospital. Joachim and Conti Streets, Mobile, Ala.

1893.—Matas, R., M.D. Professor of Surgery, Medical Department of Tulane University; Fellow of the American Surgical Association. *President*, 1911. 3523 Prytania St., New Orleans, La.

1917.—Maury, John M., M.D. Professor of Gynecology, University of Tennessee College of Medicine; Gynecologist, Memphis General and Baptist Memorial Hospitals. Bank of Commerce Building, Memphis, Tenn.

1902.—Mayo, Charles H., M.D. Attending Surgeon, St. Mary's Hospital; Fellow of American Surgical Association;

ex-President, Western Surgical Association and of Minnesota State Medical Society. Rochester, Minn.

1898.—Miller, C. Jeff., M.D. Visiting Surgeon to Charity Hospital of Louisiana; Professor of Clinical Obstetrics and Clinical Gynecology in the Tulane University of Louisiana; Chief of the Division of Obstetrics, Gynecology and Abdominal Surgery of the Presbyterian Hospital. 1638 Joseph Street, New Orleans, La.

1916.—Miller, Edward Howe, Jr., M.D. Surgeon, Danville General Hospital; Assistant Surgeon, Southern Railway. 6 Chestnut Place, Danville, Va.

1917.—Miller, Robert Talbott, Jr., M.D. Professor of Surgery, University of Pittsburgh Medical School; Surgeon to Mercy Hospital. Diamond Bank Building, Pittsburgh, Pa.

1907.—Mitchell, James F., M.D. Surgeon to Providence Hospital. *Vice-President*, 1914. 1344 Nineteenth Street, Washington, D. C.

1901.—Mixter, Samuel Jason, M.D. Surgeon, Massachusetts General Hospital; Consulting Surgeon, Massachusetts Charity Eye and Ear Infirmary; Instructor of Surgery, Harvard Medical School. 180 Marlborough St., Boston, Mass.

1911.—Moore, John Thomas, M.D. Kress Medical Bldg., Houston, Texas.

1904.—Moran, John F., M.D. Professor of Obstetrics, Georgetown University; Obstetrician to Georgetown University Hospital and Columbia Hospital for Women. 2426 Pennsylvania Avenue, Washington, D. C.

1902.—Morris, Lewis C., M.D. Professor of Anatomy and Associate Professor of Gynecology, Birmingham Medical College; Councillor of Medical Association, State of Alabama. *Vice-President*, 1910. 1203–6 Empire Building, Birmingham, Ala.

1900.—Morris, Robert Tuttle, M.D. Professor of Surgery, New York Post-Graduate Medical School and Hospital. 616 Madison Avenue, New York, N. Y.

1916.—Murphy, Fred Towsley, M.D. 2248 Penobscot Building, Detroit, Mich.

1916.—Newell, E. Dunbar, M.D. Surgeon to the Newell and Newell Sanitarium; Consulting Surgeon to the Erlanger Hospital. Chattanooga, Tenn.

1889.—Nicolson, William Perrin, M.D. Professor of Anatomy and Clinical Surgery, Atlanta College of Physicians and Surgeons; Visiting Surgeon to Grady Hospital; Senior Surgeon to Wesley Memorial Hospital; Senior Surgeon, St. Joseph's Hospital. *Vice-President,* 1900. Healey Building, Atlanta, Ga.

1890.—Noble, George H., M.D. Dean and Professor of Abdominal Surgery and Clinical Gynecology, Atlanta School of Medicine; Gynecologist of Grady Hospital; Senior Gynecologist, Wesleyan Memorial Hospital, Atlanta; Fellow of the American Gynecological Association and the American Association of Obstetricians and Gynecologists; ex-President of the Medical Association of Georgia; ex-Secretary of the Section of Obstetrics, American Medical Association. *Vice-President,* 1901; *President,* 1906. 131 South Pryor Street, Atlanta, Ga.

1911.—Norris, Henry, M.D. Rutherfordton, N. C.

1901.—Ochsner, A. J., M.D. Adjunct Professor of Clinical Surgery, College of Physicians and Surgeons; Surgeon-in-Chief, Augustana and St. Mary's Hospital. 2106 Sedgwick Street, Chicago, Ill.

1903.—Ochsner, Edward H., M.D. Surgeon to Augustana and St. Mary's Hospital. 2106 Sedgwick Street, Chicago, Illinois.

1902.—Oliver, John Chadwick, M.D. Dean and Professor of Operative Surgery, Miami Medical College; Surgeon to the Cincinnati, Christ, and Presbyterian Hospitals. 628 Elm Street, Cincinnati, Ohio.

1888.—Parham, F. W., M.D. Professor of Surgery in the New Orleans Polyclinic. *Vice-President,* 1899; *President,* 1908. 1429 Seventh Street, New Orleans, La.

1910.—Payne, Robert Lee, M.D. Assistant Gynecologist to St. Vincent's Hospital; Surgeon to the Southern Railway; Consulting Surgeon to the Seaboard Air Line Railway. 300 Freemason St., Norfolk, Va.

1916.—Peck, Charles H., M.D. Professor of Clinical Surgery, Columbia University; Surgeon to Roosevelt Hospital. 30 W. Fiftieth Street, New York, N. Y.

1899.—Perkins, W. M., M.D. Chief of the Clinic Chair of General Clinical and Operative Surgery, New Orleans Poly-

clinic; Assistant Demonstrator of Operative Surgery, Medical Department, Tulane University of Louisiana; Visiting Surgeon to the Charity Hospital. 830 Canal Street, New Orleans, Louisiana.

1908.—Peterson, Reuben, A.M., M.D. Professor of Obstetrics and Gynecology, University of Michigan; Obstetrician and Gynecologist-in-Chief to the University of Michigan Hospital. Ann Arbor, Mich.

1899.—Platt, Walter Brewster, M.D. Surgeon to the Robert Garrett Hospital for Children. 802 Cathedral Street, Baltimore, Md.

1917.—Pool, Eugene H., M.D. Clinical Professor of Surgery, Columbia University, College of Physicians and Surgeons; Attending Surgeon, New York Hospital. 107 East Sixtieth Street, New York, N. Y.

1900.—Porter, Miles F., M.A., M.D. Surgeon to Hope Hospital; Professor of Surgery, Indiana University School of Medicine. 47 West Wayne Street, Fort Wayne, Ind.

1900.—Ransohoff, Joseph, M.D., F.R.C.S. Professor of Anatomy and Clinical Surgery, University of Cincinnati; Surgeon to Cincinnati, Good Samaritan, and Jewish Hospitals; Member of American Surgical Association. 19 West Seventh Street, Cincinnati, Ohio.

1911.—Reder, Francis, M.D. Surgeon, St. Louis City and St. John's Hospitals and Missouri Sanatorium. Delmar Building, St. Louis, Mo.

1890.—Reed, Charles Alfred Lee, M.D. Ex-President of the American Medical Association; Professor of Gynecology and Abdominal Surgery in the Cincinnati College of Medicine and Surgery; Surgeon to the Cincinnati Free Hospital for Women; Fellow of the American Association of Obstetricians and Gynecologists; Fellow of the British Gynecological Society; ex-Chairman of the Section on Obstetrics and Diseases of Women of the American Medical Association; Secretary-General of the Pan-American Medical Congress, 1893; Honorary Member of the Medical Society of the State of New York. 19 W. Seventh Street, Cincinnati, Ohio.

1914.—Rhodes, Goodrich Barbour, A.B., M.D. Assistant Clinical Professor of Surgery, Ohio-Miami Medical College of the University of Cincinnati; Junior Attending Surgeon, Cin-

cinnati and Good Samaritan Hospitals and Episcopal Hospital for Children. 4 West Seventh Street, Cincinnati, Ohio.

1917.—Rhodes, Robert L., A.B., M.D. 1103–5 Lamar Building, Augusta, Ga.

1919.—Richardson, Edward Henderson, A.B., M.D. Associate in Clinical Gynecology, Johns Hopkins University, Medical Department; Visiting Gynecologist, Union Protestant Infirmary, Church Home and Infirmary, Hebrew Hospital and Asylum, Bay View Hospital, Hospital for Women of Maryland; Assistant Visiting Gynecologist, John Hopkins Hospital. 200 N. Charles St., Baltimore, Maryland.

1912.—Richardson, Edward P., M.D. Surgeon to Outpatients, Massachusetts General Hospital, and Surgeon to the Robert B. Brigham Hospital for Chronic Diseases. 224 Beacon Street, Boston, Mass.

1888.—Roberts, William O., M.D. Professor of Principles of Surgery and Clinical Surgery, Medical Department of the University of Louisville; formerly Secretary of the Surgical Section of the American Medical Association. *Vice-President*, 1889; *President*, 1910. Atherton Building, Louisville, Ky.

1901.—Robins, Charles Russell, M.D. Professor of Gynecology, Medical College of Virginia; Gynecologist to the Memorial Hospital; Surgeon to the Atlantic Coast Railroad. *Vice-President.* 8 West Grace Street, Richmond, Va.

1917.—Robinson, Julian McG., M.D. 753 Main Street, Danville, Va.

1906.—Rogers, Carey Pegram, M.D. Chief of Surgical Staff, St. Luke's Hospital; Consulting Surgeon, Seaboard Air Line Railway. *Vice-President*, 1918. 221 Laura Street, Jacksonville, Florida.

1901.—Rogers, Mack, M.D. Professor of Anatomy, Birmingham Medical College. 212 Twentieth Street, Birmingham, Alabama.

1901.—Rosser, Charles M., M.D. Professor of Surgery, Baylor University, College of Medicine; Consulting Surgeon, Parland Hospital; Attending Surgeon, Texas Baptist Memorial Sanitarium; ex-Vice-President Texas State Medical Association; Vice-President, Tri-State Society of Texas, Louisiana, and Arkansas. *Treasurer*, 1904–07. 432 Gaston Avenue, Dallas, Texas.

1899.—Royster, Hubert Ashley, A.B., M.D. Surgeon to Rex Hospital; Surgeon-in-Chief, St. Agnes' Hospital; Surgeon to Southern Railway. *Vice-President*, 1907. *Secretary*. 423 Fayetteville Street, Raleigh, N. C.

1909.—Ruffin, Kirkland, M.D. Surgeon-in-Charge of St. Christopher's Hospital. 218 York Street, Norfolk, Va.

1908.—Russell, Wm. Wood, M.D. Associate Professor of Gynecology, Johns Hopkins University; Associate in Gynecology, Johns Hopkins Hospital; Gynecologist to Union Protestant Infirmary, Baltimore. 1208 Eutaw Place, Baltimore, Md.

1893.—Saunders, Bacon, M.D. Professor of Surgery and Clinical Surgery and Dean of Faculty of Medical Department, Fort Worth University; ex-President, Texas State Medical Association. *Vice-President*, 1903; *Member of Council*, 1908–1913. *President*, 1915. Flatiron Bldg., Fort Worth, Texas.

1907.—Scott, Arthur Carroll, M.D. Senior Surgeon, Temple Sanatorium. *Vice-President*, 1914. Temple, Texas.

1915.—Seelig, Major G., A.B., M.D. Professor of Surgery, St. Louis University School of Medicine; Attending Surgeon, Jewish and St. Louis City Hospitals; Chief of Surgical Out-Patient Department, Jewish Hospital. Wall Building, St. Louis, Mo.

1899.—Shands, A. R., M.D. Professor of Orthopedic Surgery in the Medical Department of the George Washington University and in the University of Vermont; Orthopedic Surgeon to the George Washington University Hospital, the Emergency Hospital, and Central Dispensary; Charter Member, Washington Academy of Sciences; Member of American Orthopedic Association; and Honorary Member of Medical Society of Virginia. 901 Sixteenth Street, N. W., Washington, D. C.

1914.—Shands, Harley R., A.B., M.D. Visiting Surgeon, Mississippi State Charity and Baptist Hospitals. Century Building, Jackson, Miss.

1917.—Sherk, Henry H., M.D. Central Building, Pasadena, Cal.

1902.—Sherrill, J. Garland, M.D. Professor of Surgery and Clinical Surgery, University of Louisville; Consulting Surgeon to Louisville Hospital. *Vice-President*, 1911. Atherton Building, Louisville, Ky.

1900.—Simpson, Frank Farrow, M.D. Assistant Gynecologist, Mercy Hospital; Gynecologist to Out-patient Department, Mercy Hospital. Jenkins Arcade Bldg., Pittsburgh, Pa.

1913.—Simpson, James Knox, M.D. Attending Gynecologist, St. Luke's Hospital; Associate Gynecologist, Duval County Hospital, Jacksonville, Fla.

1917.—Sistrunk, W. E., M.D. Mayo Clinic, Rochester, Minnesota.

1919.—Smyth, John, M.D. 724 Baronne St., New Orleans, Louisiana.

1899.—Smythe, Frank David, M.D. Gynecologist to St. Joseph's and City Hospitals; Professor of Gynecology, Didactic and Clinical, in the Memphis Hospital Medical College; ex-President West Tennessee Medical and Surgical Association; formerly Member of the Mississippi State Board of Health and State Board of Medical Examiners of Mississippi. Porter Building, Memphis, Tenn.

1916.—Souchon, Marion, M.D. House Surgeon, Hotel Dieu; Surgeon French Hospital; Assistant Professor of Clinical Surgery, Tulane University; Visiting Surgeon, Charity Hospital. Whitney Bank Bldg., New Orleans, La.

1904.—Stokes, James Ernest, M.D. *Vice-President,* 1917. Salisbury, N. C.

1918.—Stone, Harvey B., A.B., M.D. Instructor in Surgery, Johns Hopkins University; Associate Professor of Surgery, University of Maryland and College of Physicians and Surgeons; Member of Staff, Union Protestant Infirmary, Church Home and Infirmary, and Hebrew Hospital. 18 West Franklin St., Baltimore, Md.

1894.—Talley, Dyer F., A.M., M.D. Surgeon-in-Chief of Talley's Private Infirmary; Attending Surgeon to Hillman Hospital; ex-President of the Jefferson County Medical Society; Member of the Medical Association of the State of Alabama, of the Southern Medical Association, of the Alumni Association of the Charity Hospital of Louisiana, of the Board of Censors of the Jefferson County Medical Society, of the Board of Censors of the Committee of Health and Examining Board of the Medical Association of the State of Alabama; ex-Member of the Advisory Board for Selective Draft; Fellow of the American College of Surgeons. 1808 Seventh Avenue, Birmingham, Alabama.

1892. Thompson, J. E., M.D. Professor of Surgery in the University of Texas. *Vice-President*, 1912. *President*. Galveston, Tex.

1916.—Thorning, W. Burton, M.D. Chief Surgeon of the Gulf Coast Lines. Kress Building, Houston, Texas.

1908.—Torrance, Gaston, M.D. Member Surgical Staff Hillman Hospital; also the Sisters' Hospital and St. Vincent's; Fellow of the American Association of Obstetricians and Gynecologists. 328 Woodward Building, Birmingham, Ala.

1909.—Trout, Hugh Henry, M.D. Surgeon-in-Chief of Jefferson Surgical Hospital, Roanoke, Va. 1303 Franklin Road, Roanoke, Va.

1917.—Tupper, Paul Y., M.D. Clinical Professor of Surgery, Washington University Medical School; Visiting Surgeon St. Luke's Hospital; Consulting Surgeon, Missouri Baptist Sanitarium, Bethesda, Jewish and St. John's Hospitals, St. Louis Eye, Ear, Nose and Throat Infirmary. Wall Building, St. Louis, Mo.

1912.—Turck, Raymond C., M.D. Consolidated Building, Jacksonville, Fla.

1893.—Vander Veer, Albert, M.D. Professor of Clinical, Didactic, and Abdominal Surgery, Albany Medical College; ex-President of the American Surgical Association; ex-President of the American Association of Obstetricians and Gynecologists; ex-President of the Medical Society of the State of New York. 28 Eagle Street, Albany, New York.

1909.—Vaughan, George Tully, M.D. Professor of Surgery and Head of Department of Surgery in Georgetown University; Chief Surgeon in Georgetown University Hospital; Visiting Surgeon, Tuberculosis Hospital; Consulting Surgeon, St. Elizabeth's Hospital; Consulting Surgeon, Washington Asylum Hospital. 1718 I Street, Washington, D. C.

1919.—Venable, Charles Scott, M.D. Attending Surgeon Lee Surgical Hospital, San Antonio, Texas; Attending Surgeon, Robert B. Green Memorial Hospital, San Antonio, Texas. Central Trust Building, San Antonio, Texas.

1912.—Walker, George, M.D. Associate in Surgery, Johns Hopkins University. 1 E. Centre St., Baltimore, Maryland.

1911.—Waring, T. P., M.D. Savannah, Ga.

1905.—Wathen, John R., A.B., M.D. Professor of Principles and Practice of Surgery and Clinical Surgery, University

of Louisville; Surgeon to St. Anthony's, Louisville City, and University of Louisville Hospitals. 628 Fourth Avenue, Louisville, Ky.

1907.—Watts, Stephen H., M.D. Professor of Surgery University of Virginia; Surgeon-in-Chief and Director of the University of Virginia Hospital. University of Virginia, Charlottesville, Va.

1888.—Westmoreland, Willis F., M.D. Professor of Surgery, Atlanta College of Physicians and Surgeons. *Vice-President*, 1908. 241 Equitable Building, Atlanta, Ga.

1907.—Willis, A. Murat, M.D. Instructor in Abdominal Surgery, Medical College of Virginia; Junior Surgeon to Memorial Hospital, Richmond, Va. 405 East Grace Street, Richmond, Va.

1913.—Windell, James Tolbert, M.D. 715 West Jefferson Street, Louisville, Ky.

1905.—Winslow, Randolph, M.D., LL.D. Professor of Surgery, University of Maryland; Chief Surgeon, University Hospital; Consulting Surgeon, Hebrew Hospital, and to Hospital for Crippled Children. 1900 Mt. Royal Terrace, Baltimore, Md.

1905.—Witherspoon, T. Casey, M.D. Formerly Professor of Operative and Clinical Surgery, Medical Department, St. Louis University; Member of American Association of Anatomists. 307 West Granite Street, Butte, Mont.

1900.—Young, Hugh H., M.D. Clinical Professor of Urology, Johns Hopkins University Medical Department. 330 North Charles Street, Baltimore, Md.

1902.—Zinke, E. Gustav, M.D. Professor of Obstetrics and Clinical Midwifery in the Ohio-Miami Medical College, University of Cincinnati, 1896–1916; Emeritus Professor of Obstetrics, 1916; Honorary Chief of Staff and Obstetrician and Gynecologist to the German Hospital; President of the Cincinnati Obstetric Society, 1887; President, Academy of Medicine of Cincinnati, 1894; Member and Chairman of Section on Obstetics, Gynecology and Abdominal Surgery, American Medical Association, 1914; Fellow (and Secretary) of American Association of Obstetricians and Gynecologists; Honorary Member, Jackson County Medical Society, Kansas City, Mo.; Honorary Member, Cincinnati Obstetricians and Gynecologists, 1908. 4 West Seventh Street, Cincinnati, Ohio.

GEOGRAPHICAL LIST OF FELLOWS

ALABAMA

Baker, James Norment, 719 Madison Ave., Montgomery.
Cole, Herbert Phalon, 202 Conti St., Mobile.
Du Bose, Francis Goodwin, Selma.
Heflin, Wyatt, Birmingham.
Hill, Robert Somerville, Montgomery.
Hogan, Edgar P., 412–14 Empire Bldg., Birmingham.
Jackson, William R., 164 St. Michael St., Mobile.
Jordan, William Mudd, 501 Woodward, Bldg., Birmingham.
Ledbetter, Samuel L., Jr., First National Bank Bldg., Birmingham.
Lupton, Frank A., 816 Woodward Bldg., Birmingham.
McAdory, Wellington P., Birmingham.
Mason, J. M., 1915 Sixteenth Ave., S., Birmingham.
Mastin, William M., Joachim and Conti Sts., Mobile.
Morris, Lewis C., 1203–6 Empire Bldg., Birmingham.
Rogers, Mack, 212 Twentieth St., Birmingham.
Talley, Dyer F., 1801 Seventh Ave., Birmingham.
Torrance, Gaston, 328 Woodward Bldg., Birmingham.

CALIFORNIA

Gilcreest, Edgar L., 3698 California St., San Francisco.
Sherk, Henry H., Central Building, Pasadena.

FLORIDA

Helms, John Sullivan, Tampa.
Holden, Gerry R., 223 W. Forsyth St., Jacksonville.
Rogers, Carey Pegram, 221 Laura St., Jacksonville.
Simpson, James Knox, Jacksonville.
Turck, Raymond C., Consolidated Bldg., Jacksonville.

GEORGIA

Doughty, W. H., 822 Greene St., Augusta.
Earnest, John G., 828 Candler Bldg., Atlanta.

ELKIN, WILLIAM SIMPSON, 27 Luckie St., Atlanta.
GOLDSMITH, W. S., 262 Jackson St., Atlanta.
HODGSON, FRED. G., 728 Candler Bldg., Atlanta.
JONES, EDWARD GROVES, 714 Hurt Bldg., Atlanta.
MCRAE, FLOYD WILCOX, Peters Bldg., Atlanta.
NICOLSON, WILLIAM PERRIN, 1900 Healy Bldg., Atlanta.
NOBLE, GEORGE H., 131 S. Pryor St., Atlanta.
RHODES, ROBERT L., 1103–5 Lamar Bldg., Augusta.
WARING, T. P., Savannah.
WESTMORELAND, WILLIS F., 241 Equitable Bldg., Atlanta.

ILLINOIS

LEWIS, DEAN D., 122 S. Michigan Ave., Chicago.
MARTIN, FRANKLIN H., 30 North Michigan Ave., Chicago.
OCHSNER, A. J., 2106 Sedgwick Street, Chicago.
OCHSNER, EDWARD H., 2106 Sedgwick St., Chicago.

INDIANA

PORTER, MILES F., 47 W. Wayne St., Fort Wayne.

KENTUCKY

ABELL, IRVIN, 1228 Second St., Louisville.
BARROW, DAVID, 148 Market St., Lexington.
FRANK, LOUIS, 400 Atherton Bldg., Louisville.
GRANT, HORACE H., 329 Atherton Bldg., Louisville.
HANES, GRANVILLE S., Atherton Bldg., Louisville.
HENDON, GEORGE A., 968 Baxter Ave., Louisville.
ROBERTS, WILLIAM O., Atherton Bldg., Louisville.
SHERRILL, J. GARLAND, Atherton Bldg., Louisville.
WATHEN, JOHN R., 628 Fourth Ave., Louisville.
WINDELL, JAMES T., 715 West Jefferson St., Louisville.

LOUISIANA

ALLEN, CARROLL W., 1312 Louisiana Ave., New Orleans.
CLARK, S. M. D., 1435 Harmony St., New Orleans.
COCRAM, HENRY S., 108 Baronne St., New Orleans.

Danna, Joseph A., Charity Hospital, New Orleans.
Gessner, Herman B., 1105 Maison Blanche Bldg., New Orleans.
Kohlman, William, 3500 Prytania St., New Orleans.
Landry, Lucian, 2255 St. Charles Ave., New Orleans.
Maes, Urban, 1671 Octavia St., New Orleans.
Martin, E. Denegre, 741 Carondelet St., New Orleans.
Matas, Rudolph, 3523 Prytania St., New Orleans.
Miller, C. Jeff, 1638 Joseph St., New Orleans.
Parham, F. W., 1429 Seventh St., New Orleans.
Perkins, W. M., 830 Canal St., New Orleans.
Smyth, John, 724 Baronne St., New Orleans.
Souchon, Marion, Whitney Bank Bldg., New Orleans.

MAINE

Cousins, William Lewis, 231 Woodford St., Portland.

MARYLAND

Baer, William S., 4 W. Madison St., Baltimore.
Bagley, Charles, Jr., 5 W. Chase St., Baltimore.
Bloodgood, Joseph C., 904 N. Charles St., Baltimore.
Burnam, Curtis Field, 1418 Eutaw Place, Baltimore.
Cullen, Thomas Stephen, 20 E. Eager St., Baltimore.
Davis, John Staige, 1200 Cathedral St., Baltimore.
Finney, J. M. T., 1300 Eutaw Place, Baltimore.
Hunner, Guy LeRoy, 2305 St. Paul St., Baltimore.
Kelly, Howard Atwood, 1418 Eutaw Place, Baltimore.
McGlannan, Alexius, 114 W. Franklin St., Baltimore.
Martin, Frank, 1000 Cathedral St., Baltimore.
Platt, Walter Brewster, 802 Cathedral St., Baltimore.
Richardson, Edward H., 1200 N. Charles St., Baltimore.
Russell, William Wood, 1208 Eutaw Place, Baltimore.
Stone, Harvey B., 18 West Franklin St., Baltimore.
Walker, George, 1 E. Centre St., Baltimore.
Winslow, Randolph, 1900 Mount Royal Terrace, Baltimore.
Young, Hugh H., 330 N. Charles St., Baltimore.

MASSACHUSETTS

Marcy, Henry Orlando, 180 Commonwealth Ave., Boston.
Mixter, Samuel Jason, 180 Marlborough St., Boston.
Richardson, Edward P., 224 Beacon St., Boston.

MICHIGAN

Cullen, Ernest K., David Whitney Bldg., Detroit.
Murphy, Fred T., 2248 Penobscot Building, Detroit.
Peterson, Reuben, Ann Arbor.

MINNESOTA

Balfour, Donald Church, Rochester.
Judd, Edward Starr, Rochester.
Law, Arthur Ayer, Syndicate Bldg., Minneapolis.
Mayo, Charles H., Rochester.
Sistrunk, W. E., Rochester.

MISSISSIPPI

Barksdale, John W., Winona.
Crawford, Walter W., Hattiesburg.
Shands, Harley R., Century Bldg., Jackson.

MISSOURI

Bailey, Fred W., 633 Metropolitan Bldg., St. Louis.
Bartlett, Willard, 4257 Washington Blvd., St. Louis.
Blair, Vilray Papin, Metropolitan Bldg., St. Louis.
Clopton, Malvern B., Humboldt Building, St. Louis, Mo.
Elbrecht, O. H., 423 Metropolitan Bldg., St. Louis.
Jonas, Ernst, 4495 Westminster Place, St. Louis.
Kirchner, Walter C. G., 508 Metropolitan Bldg., St. Louis.
Lewis, Bransford, Century Bldg., St. Louis.
Reder, Francis, Delmar Bldg., St. Louis.
Seelig, Major G., Wall Bldg., St. Louis.
Tupper, Paul Y., Wall Bldg., St. Louis.

MONTANA

Witherspoon, T. Casey, 307 West Granite Street, Butte.

NEW JERSEY

Ill, Edward Joseph, 1002 Broad St., Newark.

NEW YORK

Boldt, Herman J., 39 E. 61st St., New York City.
Coley, William B., 40 E. 41st St., New York City.
Downes, William Augustus, 37 W. 71st St., New York City.
Gerster, John C. A., 34 E. 75th St., New York City.
Lloyd, Samuel, 15 E. 42d St., New York City.
Morris, Robert Tuttle, 616 Madison Ave., New York City.
Peck, Charles H., 30 W. 50th St., New York City.
Pool, Eugene H., 107 E. 60th St., New York City.
Vander Veer, Albert, 28 Eagle St., Albany.

NORTH CAROLINA

Biggs, Montgomery Herman, Rutherfordton.
Fletcher, Marshall H., 17 Church St., Asheville.
Gibbon, Robert L., Charlotte.
Norris, Henry, Rutherfordton.
Royster, Hubert Ashley, 423 Fayetteville St., Raleigh.
Stokes, James Ernest, Salisbury.

OHIO

Bonifield, Charles Lybrand, 409 Broadway, Cincinnati.
Caldwell, C. E., The Livingstone, 7th and Race Sts., Cincinnati.
Carothers, Robert, 413 Broadway, Cincinnati.
Crile, George W., 1021 Prospect Ave., Cleveland.
Freiberg, Albert H., Livingstone Building, Cincinnati.
Hall, Rufus Bartlett, 628 Elm St., Cincinnati.
Oliver, John Chadwick, 628 Elm St., Cincinnati.
Ransohoff, Joseph, 19 W. 7th St., Cincinnati.
Reed, Charles Alfred Lee, 19 W. 7th St., Cincinnati.
Rhodes, Goodrich Barbour, 4 W. Seventh St., Cincinnati.
Zinke, E. Gustav, 4 W. Seventh St., Cincinnati.

OREGON

Coffey, Robert C., Stevens Building, Portland.

PENNSYLVANIA

Clark, John G., 2017 Walnut St., Philadelphia.
Deaver, John B., 1634 Walnut St., Philadelphia.
Frazier, Charles H., 1724 Spruce St., Philadelphia.
Miller, Robert Talbott, Jr., Diamond Bank Bldg., Pittsburgh.
Simpson, Frank Farrow, Jenkins Arcade Bldg., Pittsburgh.

SOUTH CAROLINA

Buist, A. Johnston, 279 Meeting Street, Charleston.
Cathcart, R. S., 66 Hasell St., Charleston.
Guerry, Le Grand, Columbia.

TENNESSEE

Barr, Richard Alexander, First National Bank Bldg., Nashville.
Black, William T., Exchange Bldg., Memphis.
Bryan, W. A., 146 Eighth Ave., N., Nashville.
Burch, Lucius E., 706 Church St., Nashville.
Caldwell, Robert, 315 Jackson Bldg., Nashville.
Cowden, Charles N., Hitchcock Bldg., Nashville.
Crisler, Joseph Augustus, Memphis Trust Bldg., Memphis.
Fort, Rufus E., 209 Seventh Ave., N., Nashville.
Haggard, William David, 706 Church St., Nashville.
Malone, Battle, 1701 Exchange Bldg., Memphis.
Maury, John M., Bank of Commerce Bldg., Memphis.
Newell, E. Dunbar, Chattanooga.
Smythe, Frank David, Porter Bldg., Memphis.

TEXAS

Moore, John Thomas, Kress Bldg., Houston.
Rosser, Charles M., 432 Gaston Ave., Dallas.
Saunders, Bacon, Flatiron Bldg., Fort Worth.
Scott, Arthur Carroll, Temple.
Thompson, J. E., Galveston.
Thorning, W. Burton, Kress Bldg., Houston.
Venable, Charles S., Central Trust Building, San Antonio.

VIRGINIA

Baughman, Greer, 26 N. Laurel St., Richmond.
Bell, Richard Phillip, Masonic Bldg., Staunton.
Bosher, Lewis Crenshaw, 422 E. Franklin St., Richmond.
Bryan, Robert C., First and Main Sts., Richmond.
Coleman, Claude C., 200 W. Grace St., Richmond.
Gwathmey, Lomax, Norfolk.
Henson, J. W., Richmond.
Horsley, John Shelton, 617 W. Grace St., Richmond.
La Roque, G. Paul, 501 East Grace St., Richmond.
Leigh, Southgate, 147 Granby St., Norfolk.
McGuire, Stuart, 518 E. Grace St., Richmond.
McGuire, W. Edward, 411 E. Grace St., Richmond.
MacLean, Henry Stuart, 406 W. Grace St., Richmond.
Miller, Edward Howe, Jr., 6 Chestnut Place, Danville.
Payne, Robert Lee, 300 Freemason St., Norfolk.
Robins, Charles Russell, 8 W. Grace St., Richmond.
Robinson, Julian McG., 753 Main St., Danville.
Ruffin, Kirkland, 218 York St., Norfolk.
Trout, Hugh Henry, 1303 Franklin Road, Roanoke.
Watts, Stephen H., Charlottesville.
Willis, A. Murat, 405 E. Grace St., Richmond.

WEST VIRGINIA

Cannaday, John Egerton, 100 Capitol St., Charleston.

WASHINGTON, D. C.

Balloch, Edward A., 1511 Rhode Island Ave., N. W.
Bovée, J. Wesley, The Rochambeau.
Carr, William P., 1418 L. Street, N. W.
Hagner, Francis Randall, The Farragut.
Kerr, Harry Hyland, 1742 N Street, N. W.
Mitchell, James F., 1344 Nineteenth St.
Moran, John F., 2426 Pennsylvania Ave.
Shands, A. R., 901 Sixteenth Street, N. W.
Vaughan, George Tully, 1718 I St.

CONSTITUTION

ARTICLE I

The name of this Association shall be THE SOUTHERN SURGICAL ASSOCIATION.

ARTICLE II

The object of this Association shall be to further the study and practice of Surgery in its various departments, especially among the profession of the Southern States.

ARTICLE III

SECTION 1. The qualifications which must be possessed by an applicant for fellowship in the Association shall be: (*a*) Good standing in his State Association; (*b*) experience covering not less than ten years of professional work; (*c*) practice limited essentially to surgery or one of its specialties; (*d*) recommendation by three Fellows, two preferably from his own State.

SECTION 2. Application for Fellowship shall be filed with the Secretary on the blank form provided for that purpose. The Council at each annual session shall carefully consider all candidates and may nominate one for each vacancy that exists on the roll for election or rejection by the Association.

ARTICLE IV

The Honorary Fellows of the Association shall not exceed twenty-five in number. They shall be nominated by the Council and elected by the Association. They will not be required to pay any dues and shall enjoy all the privileges of other Fellows except that of voting or holding office; this exception does not apply to Founders.

ARTICLE V

SECTION 1. The officers of this Association shall be a President, two Vice-Presidents, a Secretary, a Treasurer, and a Council, elected by ballot.

SEC. 2. The President and Vice-Presidents shall be elected for one year, and the President shall not be eligible for reëlection at any time; the Secretary and Treasurer, each, for five years; and the Council as provided for in the By-laws.

ARTICLE VI

SECTION 1. It shall be the duty of the President to preside at all meetings of the Association; to give the casting vote; to see that the rules of order and decorum be properly enforced in all deliberations of the Association; to sign the approved proceedings of each meeting, and to approve such orders as may be drawn upon the Treasurer for expenditures ordered by the Association.

SEC. 2. In the absence of the President the first Vice-President shall preside, and in his absence the second Vice-President shall preside.

SEC. 3. In the absence of all three, the Association shall elect one of its Fellows to preside *pro tem.*

SEC. 4. It shall be the duty of the Secretary to keep a true and correct record of the proceedings of the meetings; to preserve all books, papers, and articles belonging to the archives of the Association; to attest all orders drawn on the Treasurer for moneys appropriated by the Association; to keep the account of the Association with its Fellows; to keep a register of the Fellows, with the dates of their admission and places of residence. He shall collect all moneys due from the Fellows and pay to the Treasurer, taking his receipt for the same. He shall report such unfinished business of previous meetings as may appear on his books requiring action, and attend to such other business as the Association may direct. He shall also supervise and conduct all the correspondence of the Association, and edit the TRANSACTIONS under the direction of the Council.

SEC. 5. It shall be the duty of the Treasurer to keep a correct record of all moneys received from the hands of the Secretary, giving his receipt for the same; pay them out by order of the Association as indorsed by the President and attested by the seal in the hands of the Secretary.

SEC. 6. It shall be the duty of the President of the Association to appoint an Auditing Committee, consisting of three Fellows of the Association, whose duty it shall be to examine the books of the Secretary and Treasurer, and report on the same on the last day of the session.

ARTICLE VII

Vacancies occurring in the offices of the Association shall be filled by appointment of the President until the next meeting. He shall also have the appointment of all committees not otherwise provided for.

ARTICLE VIII

This Constitution shall take effect immediately from the time of its adoption, and shall not be amended except by a written resolution, which shall lie over one year, and receive a vote of two-thirds of the members present.

ARTICLE IX

The Fellowship of the Association shall be limited to two hundred.

BY-LAWS

ARTICLE I

The Southern Surgical Association shall meet annually on the Tuesday of the week preceding the week in which Christmas occurs, at 10 A.M., at such place as may be designated at the preceding meeting.

ARTICLE II

The Fellows present shall constitute a quorum for business.

ARTICLE III

The annual dues of each Fellow shall be $15, paid in advance.

ARTICLE IV

The usual parliamentary rules governing deliberative bodies shall govern the business workings of this Association.

ARTICLE V

All questions before the Association shall be determined by a majority of the votes present.

ARTICLE VI

The President shall deliver an annual address at each meeting of the Association.

ARTICLE VII

The Secretary of the Association shall receive at each annual Session a draft from the President, drawn on the Treasurer, for such sum as may be voted him by the Council, for services rendered the Association, and to this shall be added the necessary expense incurred in the discharge of his official duties.

ARTICLE VIII

It shall be the duty of the Secretary, one month prior to the annual meeting, to notify the Fellows of the Association and urge their attendance.

ARTICLE IX

The authors of papers shall notify the Secretary, six weeks prior to the meeting, of the titles of their essays, so that they may be incorporated in the preliminary programme.

ARTICLE X

COUNCIL

The Council shall consist of five members; and of those elected at the primary meeting, the first shall serve five years, the second four, and the third three, the fourth two, and the fifth one year; so that subsequently one member of the Council shall be elected annually to serve five years. No member of the Council shall be eligible for reëlection. The President and Secretary shall be *ex-officio* members of the Council.

This Council shall organize by electing a Chairman and Secretary, and shall keep a record of its proceedings.

The duties of this Council shall be—

1. To investigate applications for membership and report to the Association the names of such persons as are deemed worthy.

2. To take cognizance of all questions of an ethical, judicial, or personal nature, and upon these the decision of the Council shall be final; *provided*, that appeal may be taken from such decision of the Council to the Association, under a written protest, which protest shall be sustained by the Association, and the matter shall then be referred to a special committee, with power to take final action.

3. All motions and resolutions before the Association shall be referred to the Council without debate, and it shall report by recommendation at as early an hour as possible.

ARTICLE XI

The President shall appoint at each annual meeting a Committee of Arrangements.

ARTICLE XII

The Council shall have full power to omit from the published TRANSACTIONS, in part or in whole, any paper that may be referred to it by the Association, unless specially instructed to the contrary by the Association, which will be determined by vote.

ARTICLE XIII

The Council shall have power to drop from the roll of Fellows any member who fails to pay his dues for more than one year, or misses three consecutive sessions of the Association, or who for any reason fails to retain his good standing in his State association.

ARTICLE XIV

No paper shall be read before this Association which does not deal strictly with a subject of surgical or gynecological importance.

ARTICLE XV

No paper read before this Association shall be published in any medical journal or pamphlet for circulation, as having been read before the Association, without having received the endorsement of the Council.

ARTICLE XVI

The readings of papers shall be limited to twenty minutes each, except by permission of the Association.

MINUTES OF THE PROCEEDINGS

OF THE

THIRTY-SECOND ANNUAL MEETING

OF THE

SOUTHERN SURGICAL ASSOCIATION

HELD AT THE

HOTEL GRUNEWALD

New Orleans, Louisiana

DECEMBER 16, 17 AND 18, 1919

THIRTY-SECOND ANNUAL MEETING

FIRST DAY, *Tuesday, December* 16, 1919

The following named members were present:

ABELL, IRVIN.....Louisville, Ky.
ALLEN, CARROLL W.....New Orleans, La.
BAER, WILLIAM STEVENSON.....Baltimore, Md.
BAGLEY, CHARLES, JR.....Baltimore, Md.
BAKER, JAMES NORMENT.....Montgomery, Ala.
BARKSDALE, JOHN W.....Winona, Miss.
BARR, RICHARD ALEXANDER.....Nashville, Tenn.
BARROW, DAVID.....Lexington, Ky.
BARTLETT, WILLARD.....St. Louis, Mo.
BIGGS, MONTGOMERY HERMAN.....Rutherfordton, N. C.
BLACK, WILLIAM T.....Memphis, Tenn.
BOVÉE, J. WESLEY.....Washington, D. C.
BRYAN, W. A.....Nashville, Tenn.
BUIST, A. JOHNSTON.....Charleston, S. C
BURCH, LUCIUS E.....Nashville, Tenn.
CALDWELL, ROBERT.....Nashville, Tenn.
CAROTHERS, ROBERT.....Cincinnati, O.
CATHCART, R. S.....Charleston, S. C.
CLARK, S. M. D.....New Orleans, La.
COCRAM, HENRY S.....New Orleans, La.
COLE, HERBERT PHALON.....Mobile, Ala.
COLEMAN, CLAUDE C.....Richmond, Va.
COWDEN, CHARLES N.....Nashville, Tenn.
CRAWFORD, WALTER W.....Hattiesburg, Miss.
CRISLER, JOSEPH AUGUSTUS.....Memphis, Tenn.
CULLEN, ERNEST K.....Detroit, Mich.
CULLEN, THOMAS STEPHEN.....Baltimore, Md.
DANNA, JOSEPH A.....New Orleans, La.

DuBose, Francis Goodwin.....Selma, Ala.
Elbrecht, Oscar Herman.....St. Louis, Mo.
Fletcher, Marshall H.....Asheville, N. C.
Frank, Louis.....Louisville, Ky.
Frazier, Charles H.....Philadelphia, Pa.
Gessner, Hermann B.....New Orleans, La.
Gilcreest, Edgar L.....Gainesville, Texas
Goldsmith, W. S.....Atlanta, Ga.
Haggard, William David.....Nashville, Tenn.
Hagner, Francis Randall.....Washington, D. C.
Hanes, Granville S.....Louisville, Ky.
Heflin, Wyatt.....Birmingham, Ala.
Hendon, George A.....Louisville, Ky.
Henson, James W.....Richmond, Va.
Hill, Robert Somerville.....Montgomery, Ala.
Hodgson, Fred G.....Atlanta, Ga.
Hogan, Edgar P.....Birmingham, Ala.
Horsley, John Shelton.....Richmond, Va.
Hunner, Guy LeRoy.....Baltimore, Md.
Jackson, William R.....Mobile, Ala.
Jones, Edward Groves.....Atlanta, Ga.
Jordan, William Mudd.....Birmingham, Ala.
Judd, Edward Starr.....Rochester, Minn.
Kerr, Harry Hyland.....Washington, D. C.
Kirchner, Walter C. G.....St. Louis, Mo.
Landry, Lucian.....New Orleans, La.
Ledbetter, Samuel L., Jr.....Birmingham, Ala.
McGlannan, Alexius.....Baltimore, Md.
McGuire, Stuart.....Richmond, Va.
McRae, Floyd Wilcox.....Atlanta, Ga.
Maes, Urban.....New Orleans, La.
Malone, Battle.....Memphis, Tenn.
Martin, E. Denegre.....New Orleans, La.
Martin, Frank.....Baltimore, Md.
Mason, J. M.....Birmingham, Ala.
Mastin, William M.....Mobile, Ala.
Matas, R.....New Orleans, La.
Mayo, Charles H.....Rochester, Minn.
Miller, C. Jeff.....New Orleans, La.
Miller, Edward Howe, Jr.....Danville, Va.

MOORE, JOHN THOMAS.....Houston, Texas
MORRIS, LEWIS C.....Birmingham, Ala.
NEWELL, E. DUNBAR.....Chattanooga, Tenn.
NICOLSON, WILLIAM PERRIN.....Atlanta, Ga.
NORRIS, HENRY.....Rutherfordton, N. C.
OCHSNER, EDWARD H.....Chicago, Ill.
PARHAM, F. W.....New Orleans, La.
PAYNE, ROBERT LEE.....Norfolk, Va.
PERKINS, W. M.....New Orleans, La.
PETERSON, REUBEN.....Ann Arbor, Mich.
RANSOHOFF, JOSEPH.....Cincinnati, O.
REDER, FRANCIS.....St. Louis, Mo.
RHODES, GOODRICH BARBOUR.....Cincinnati, O.
RHODES, ROBERT L.....Augusta, Ga.
RICHARDSON, EDWARD P.....Boston, Mass.
ROBINS, CHARLES RUSSELL.....Richmond, Va.
ROBINSON, JULIAN MCG.....Danville, Va.
ROGERS, CAREY PEGRAM.....Jacksonville, Fla.
ROYSTER, HUBERT ASHLEY.....Raleigh, N. C.
SAUNDERS, BACON.....Fort Worth, Texas
SCOTT, ARTHUR CARROLL.....Temple, Texas
SEELIG, MAJOR G.....St. Louis, Mo.
SHANDS, HARLEY R.....Jackson, Miss.
SHERK, HENRY H.....Pasadena, Cal.
SMYTHE, FRANK DAVID.....Memphis, Tenn.
SOUCHON, MARION.....New Orleans, La.
STOKES, JAMES ERNEST.....Salisbury, N. C.
STONE, HARVEY B.....Baltimore, Md.
TALLEY, DYER F.....Birmingham, Ala.
THOMPSON, J. E.....Galveston, Texas
TORRANCE, GASTON.....Birmingham, Ala.
TROUT, HUGH HENRY.....Roanoke, Va.
WALKER, GEORGE.....Baltimore, Md.
WARING, T. P.....Savannah, Ga.
WATTS, STEPHEN H.....Charlottesville, Va.
WILLIS, A. MURAT.....Richmond, Va.
WINDELL, JAMES TOLBERT.....Louisville, Ky.
WINSLOW, RANDOLPH.....Baltimore, Md.

The following honorary members were present:

DAVIS, JOHN D. S.....Birmingham, Ala.
LEWIS, E. S.....New Orleans, La.
LONG, JOHN WESLEY.....Greensboro, N. C.
MCMURTRY, LEWIS S.....Louisville, Ky.
STONE, ISAAC S.....Washington, D. C.

Morning Session. The Association met in the Gold Room of the Grunewald Hotel and was called to order at 10.15 A.M. by Dr. C. Jeff Miller, Chairman of the Local Committee of Arrangements, who said:

Fellow Members of the Southern Surgical Association: As chairman of the Local Committee of Arrangements, I wish to announce the entertainments that have been arranged for you during your stay in New Orleans. We have arranged today (Tuesday) for a luncheon at the Country Club, and we will proceed there in automobiles as soon as the morning session is over. No afternoon session will be held, but instead the afternoon will be devoted to golf, to the races, yachting, motoring, etc. The Association will hold a session at 7.30 P.M. On Wednesday evening the annual dinner of the Association will be held at Antoine's restaurant, to which the guests of the Fellows of the Association and ladies are invited. We feel that the Southern Surgical Association is a working body, hence we have not arranged much entertainment for you.

Dr. Ernest S. Lewis, who is to deliver an address of welcome, has not yet arrived, and in his temporary absence we will ask Dr. Matas to say a few words of welcome.

ADDRESS OF WELCOME BY DR. MATAS

Mr. Chairman and Fellows of the Southern Surgcal Association: It is an impressive occasion to me, for after a long absence it is a great pleasure to greet so many ex-presidents of this Association today. Personally, I feel that every doctor in New Orleans who loves his profession looks to you men, as well as the young men in the profession, as their guides and leaders not only for the present, but for the future. The vision of having this Association to meet in our midst is an inspiration. It means so much to us and to the profession. I was thinking a moment

ago of the impressiveness of this Association to our young men who are now attending medical school, and what it means to them to see the great men that are assembled here, representative of the surgical profession; the men they read about every day in their medical journals and who are talked about by their teachers. What a glorious opportunity it is for them! It is needless for me to say that you are more than welcome as a Southern gathering of surgeons. It is difficult to express the fulness of the sentiment that inspires everyone of us in your coming here to hold your meeting. The Chairman of the Committee of Arrangements has mentioned the preparations that have been made for your entertainment and for the entertainment of the visiting ladies, whom we are always delighted to see. I can only express the feeling of our profession here by saying you are welcome, you are heartily welcome, and we hope the interval between this visit and your next one will not be as long. I can only repeat, gentlemen, that we are "delighted" at your coming.

Dr. Lewis having arrived, he was introduced by Dr. Miller and delivered the following

Address of Welcome

Mr. President and Fellows of the Southern Surgical Association: The honor and pleasure of addressing you is an act of courtesy extended their senior by his fellow-members of this city.

This is the fourth time you have honored us with your presence and if the memories we treasure of the profit and pleasure derived from those past events are to be regarded as presaging the present our content should be complete and mutual we hope. The claim of our city for hospitality has not been affected by the war, and you will meet with the same sincerity and warmth of welcome as in the past.

To the benefits accruing to all concerned from the reading and discussion of papers and the interchange of thoughts on subjects vital to surgery which lead to its progress and development, there is added the delightful charm of social intercourse and fraternization between members around which cluster happy memories to be cherished as sweeteners of life. But apart from their intellectual and scientific bearing, these meetings, in which

are so many distinguished and eminent members of the profession, serve also as a propaganda, inspiring the young ambitious surgeons, stimulating them to greater industry, and as beacon lights in the ethical paths they should follow.

It was my good fortune to deliver the welcome address at the first meeting here in 1893, Dr. Bedford Brown being President, and the past long dormant returns vividly to mind, in a flood of recollections not untinctured with sadness. Many changes have occurred in the last twenty-six years in the personnel of the Association. I miss many of my friends who have passed away; many who were its organizers and pioneers in gynecic and abdominal surgery in the South. They and their pioneer brethren of the north blazed the way which led to the marvellous and brilliant surgery of today, toward which members of this Association have largely contributed. It was the germinative epoch of gynecic and abdominal surgery, an important part of the transition period "for the happenings of today grow out of the events of yesterday and lead on to the events of tomorrow." At this meeting also I witnessed my first abdominal operations by other operators, although engaged in that line of work since 1876. Some of the members were requested to operate at the Charity Hospital, and Drs. Kelly, Price and McMurtry acceded. A list of about thirty cases was furnished them from my service, from which Dr. Kelly chose a fibroid and Drs. Price and McMurtry pus tubes.

The change of name to the Southern Surgical Association also revives an incident of my early career as a gynecologist. It was hinted by my friends, the general surgeons, that I should confine myself to female surgery, as they referred their cases to me. I thought this reasonable and just, and cheerfully subscribed to their wishes; but the impulse given abdominal surgery by the early gynecologists opened their eyes to the good things they were missing, and after a few lessons they took possession of that field and also retained their cases. In the meantime the gynecologist had adhered to his bargain and became identified as a female surgeon only. His status as such was fixed in the community as unalterable as the laws of the Medes and Persians. If he removed an appendix from a woman he might meet her a few months later and be told that her husband had developed the same trouble, and she would have sent for him, but knowing

he only operated on women, she had called in a general surgeon, and the gynecologist could do nothing but regret his infantile credulity. The general surgeon was well named; he had not only appropriated the abdomen, but he laid claim to the pelvis as well; and if he has spared for a time any small portion of human anatomy, it is not so much from disinclination, but from the fulness of satiety. He might apply to himself and parody the tale of the Ancient Mariner, who was heard to say:

> "I am the cook and the captain bold,
> And the mate of the Nancy brig,
> And the midshipmite and the boss'n tite
> And the crew of the captain's gig."

But the younger generation of gynecologists having learned wisdom from the sad experience of their too trustful elders, and, besides, becoming infected with the bulimia of the general surgeons, also include the entire body as their province, basing their claims on continuity or contiguity of structure as establishing relationship with the pelvis. Everything is grist that comes to their mill, "from a sebaceous cyst on the scalp to ingrowing toe-nails."

With an apology for resurrecting a past so long encoffined and entombed, but difficult of repression under the circumstances in which I am placed, let me say a few words of the changes in the city since your last meeting here in 1907. There were then evidences that New Orleans had thrown off the apathy following the Civil War and reconstruction period and was striving to resume in a measure the enviable position she held in the commercial world as second to New York in her imports and exports before those fateful events. She had put her house in order sanitarily and hygienically by instituting up-to-date drainage and sewerage and substituting asphalt for other pavements, by supplying the public with pure filtered water and more recently by ratproofing the city, which is not yet completed. She had constructed modern docks and cotton warehouses, the largest and most efficient in this country, and was fortunate in having an excellent and worthy Mayor, an active and progressive municipal government, and an enthusiastic public spirit imbued with a vision of her future greatness, sparing no effort nor cost in preparing her to take her rightful place in the sun.

Her docks now extend a distance of seven miles along the

river front and the work is still continuing. Millions have been spent in these public works and millions are yet to be spent.

The Industrial Canal, near completion, will add materially to her port facilities. Many large public and commercial buildings have been erected and many new industries established, and others are seeking suitable sites. Opportunity is knocking at her door and is being "grappled with hooks of steel." Her export trade during the past year was second to New York, and her position, 600 miles nearer to the Central and South American ports on the Atlantic and Pacific sides, makes her the logical port for trade with these countries. It is estimated that 25,000 to 30,000 have been added to her population during the past year, which exceeds 400,000. Her hotels, boarding and apartment houses are filled, and strangers and even residents find it difficult to procure accommodations.

In conclusion, let me thank you for the Honorary Fellowship conferred at your last meeting. It is an honor I greatly appreciate, as I had forfeited claim to membership by my frequent absence from your meetings. I thank you most sincerely.

THE SECRETARY.—I take the liberty of supplementing the announcements made by the Chairman of the Committee of Arrangements. I wish to emphasize the fact that the ladies are invited to the luncheon at the Country Club this afternoon. There will be no scientific session this afternoon, but the Association will meet at 7.30 this evening. The privileges and courtesies of the floor are extended to the following visiting members of the regular medical profession: Dr. Alexander Primrose, Toronto, Ontario; Dr. L. S. Pilcher, Brooklyn, New York; Dr. John S. B. Woolford, Chattanooga, Tennessee; Dr. Lawrence Ryan, Chicago, Illinois; Dr. A. J. Crowell, Charlotte, North Carolina; Dr. J. M. Clack, Rockwood, Tennessee; Dr. Foy Roberson, Durham, North Carolina; Dr. John B. Haskins, Chattanooga, Tennessee; Dr. W. P. Conaway, Atlantc City, New Jersey; Dr. John P. Munroe, Charlotte, North Carolina; Dr. Charles Farmer, Louisville, Kentucky.

Dr. James E. Thompson, Galveston, Texas, President of the Association, was then introduced. On taking the chair, President Thompson said: Before calling the scientific meeting to order, I wish to express, on behalf of the Association, the thanks of all of us for the excellent address which has just been delivered

by Dr. Lewis. We are doubly fortunate in having had two addresses. First of all, we had a very delightful sympathetic talk from Dr. Matas, to which we all listened with a great deal of pleasure. He spoke from his soul. The address of Dr. Lewis was very felicitous, and I am sure was appreciated by all of us, and it is fitting that we should show our appreciation by giving him a rising vote of thanks.

Letters and telegrams were received from the following members, who regretted their inability to attend the meeting:

Dr. Curtis F. Burnam, Baltimore; Dr. Charles E. Caldwell, Cincinnati, Ohio; Dr. Charles H. Peck, New York City; Dr. Herman J. Boldt, New York City; Dr. Robert C. Coffey, Portland, Oregon; Dr. Charles M. Rosser, Dallas, Texas; Dr. Charles A. L. Reed, Cincinnati, Ohio; Dr. LeGrand Guerry, Columbia, South Carolina; Dr. Ernst Jonas, St. Louis, Missouri; Dr. Robert T. Miller, Pittsburgh, Pnnsylvania, and Dr. J. Garland Sherrill, Louisville, Kentucky.

Papers were then read as follows:

1. "The Injection of the Gasserian Ganglion for Neuralgia and Other Conditions," by Dr. Carroll W. Allen, New Orleans, Louisiana. This paper was discussed by Drs. Matas, Maes, Parham, and the discussion closed by the essayist.

2. "The Interpretation of Muscle Function in its Relation to Injuries of the Peripheral Nerves," by Dr. C. C. Coleman, Richmond, Virginia.

3. "Gunshot Wounds of the Brain, with Retained Missiles," by Dr. Charles Bagley, Jr., Baltimore, Maryland.

4. "Late Treatment of Gunshot Wounds of the Head," by Dr. Harry H. Kerr, Washington, D. C. These papers were discussed together by Drs. Long, Coleman, DuBose, Primrose, Nicolson, McGlannan, Bagley, and Kerr.

5. "Spermatoceles and Hydroceles Containing Spermatozoa," by Dr. Randolph Winslow, Baltimore, Maryland. Discussed by Dr. Bovée.

NOTE.—There was no afternoon session. The members of the Association and their guests went to the Country Club for luncheon, after which the remainder of the afternoon was devoted to playing golf, races, motoring, etc.

Evening Session. The Association reconvened at 7.30 P.M., and was called to order by the President.

6. "Hypodermoclysis," by Dr. Willard Bartlett, St. Louis, Missouri. Discussed by Drs. Horsley, Hill, Bovée, Trout, Matas, and the discussion closed by the essayist.

7. "Shoes," by Dr. Robert Carothers, Cincinnati, Ohio, which was discussed by Dr. Mayo.

8. "Observations and Experiences in the Treatment of Arteriovenous Aneurysms by Endo-aneurysmorrhaphy *via* the Transvenous Route," by Dr. Rudolph Matas, New Orleans, Louisiana. This paper was discussed by Drs. Mayo, Horsley, Scott, and in closing by the essayist.

9. "Empyema at the Cincinnati General Hospital during the Influenza Epidemic," by Dr. Joseph Ransohoff, Cincinnati, Ohio. Discussed by Drs. McGlannan, Mayo, Mason, and in closing by the essayist.

10. "Pseudomyxoma Peritonei," by Dr. M. H. Biggs, Rutherfordton, North Carolina.

11. "Pseudomyxoma Peritonei in Male Subjects," by Dr. M. G. Seelig, St. Louis, Missouri. These two papers were discussed together by Drs. Peterson, Cullen and Matas.

12. "Congenital Diaphragmatic Hernia; Report of a Case," by Dr. Louis Frank, Louisville, Kentucky. Discussed by Dr. Kirchner.

13. "Plastic Operations about the Rectum," by Dr. Harvey B. Stone, Baltimore, Maryland.

Discussed by Dr. Hendon, after which the Association adjourned until 9 A.M. Wednesday.

SECOND DAY.—*Wednesday, December* 17, 1919

Morning Session. The Association met at 9 A.M. and was called to order by the Vice-President, Dr. Charles R. Robins, Richmond, Virginia.

14. "Further Observations on the Function of the Corpus Luteum," by Dr. Edward H. Ochsner, Chicago, Illinois. Discussed by Drs. Cullen, Bovée, Black, and in closing by the essayist.

15. "Warning against Promiscuous Curettage," by Dr. J. Wesley Bovée, Washington, D. C. This paper was discussed by Drs. Hunner, Peterson, Cullen, after which the discussion was closed by the essayist.

The President appointed as a committee to audit the books and accounts of the Secretary and Treasurer, Drs. Lewis C. Morris, A. C. Scott and William T. Black.

At this juncture, Dr. George A. Hendon, Second Vice-President, took the chair.

16. "Operative Treatment of Pelvic Inflammation," by Dr. Charles R. Robins, Richmond, Virginia. Discussed by Drs. Clark, Shands, Hunner, Ochsner, Bovée, Ochsner, DuBose, McMurtry, E. D. Martin, Mason, Bovée, Long, Hill, Barr, Henson, and in closing by the essayist.

17. "A New Suspensory Operation for Retroversion of the Uterus," by Dr. F. G. DuBose, Selma, Alabama, which was discussed by Drs. Long, Moore, Stone, Hill, Bartlett, Bovée, Black, Clark, after which the discussion was closed by the essayist.

18. "Unraveling the Mysteries of Right-sided Abdominal Pain in the Female," by Dr. James N. Baker, Montgomery, Alabama. This paper was discussed by Drs. Hunner, Baer and Ransohoff.

19. "Operation for the Reconstruction of the Anterior Abdominal Wall in Markedly Attenuated and Herniated Conditions," by Dr. S. M. D. Clark, New Orleans, Louisiana.

On motion the Association adjourned until 2 P.M.

Afternoon Session. The Association reconvened at 2 P.M. and was called to order by Vice-President Robins.

20. The President, Dr. James E. Thompson, Galveston, Texas, delivered his address. He selected for his subject, "Surgery and Embryology."

21. "Stone in the Kidney," by Dr. Charles H. Mayo, Rochester, Minnesota.

22. "The Results of Operations for the Removal of Stone in the Ureter," by Dr. E. S. Judd, Rochester, Minnesota.

23. "Uretero-ureteral Anastomosis," by Dr. Reuben Peterson, Ann Arbor, Michigan.

These three papers were discussed together by Drs. Hagner, Payne, Hunner, Crowell, Barr, Bartlett, Bovée, Winslow, Crisler, Moore, and in closing by Drs. Mayo, Judd and Peterson.

24. "Abolition of Venereal Disease," by Dr. George Walker, Baltimore, Maryland. This paper was discussed by Dr. Gilcreest, and in closing by the essayist.

25. "Sarcoma of the Stomach," by Dr. William D. Haggard, Nashville, Tennessee.

26. "Treatment of Duodenal Fistula," by Dr. Stuart McGuire, Richmond, Virginia.

These two papers were discussed jointly by Drs. Clark, Jordan, Mayo, Horsley, after which the discussion was closed by Dr. Haggard.

On motion the Association adjourned until 9 A.M., Thursday.

THIRD DAY.—*Thursday, December* 18, 1919

Morning Session. The Association met at 9 A.M. and was called to order by the President.

27. "Ileostomy for Postoperative Obstruction Following Appendectomy," by Dr. Edward P. Richardson, Boston, Massachusetts.

28. "A Successful Posterior Gastro-enterostomy Seventy-six Hours Following a Rammstedt Operation which Failed," by Dr. Frank D. Smythe, Memphis, Tennessee.

29. "Intussusception Resulting from Benign Tumor of the Intestine," by Dr. A. Murat Willis, Richmond, Virginia.

30. "Perforations of the Gastro-intestinal Tract," by Dr. Charles N. Cowden, Nashville, Tennessee.

31. "Some Abdominal Complications of Influenza," by Dr. Alexius McGlannan, Baltimore, Maryland.

These five papers were discussed together by Drs. Hill, Horsley Seelig, Bartlett, Long, Reder, Biggs, Ransohoff, Jackson, Kirchner, Winslow, Black, Stone, Danna, F. Martin, and in closing by Drs. Smythe, Richardson, Cowden and McGlannan.

REPORT OF THE COUNCIL

The Secretary presented the report of the Council.

Before reading the formal report of the Council I believe it is fitting that we should commemorate in a special way the recent death of our ex-President, Dr. John Young Brown, of St. Louis, Missouri. The following message has been received from Dr. Fred W. Bailey, a Fellow of the Association:

St. Louis, Mo., December 16, 1919

Dr. H. A. Royster, Secretary, Southern Surgical Association, Hotel Grunewald, New Orleans, Louisiana:

Dr. John Young Brown, ex-President of this organization, at the age of fifty-four years, passed away at Phoenix, Arizona, on October 30, 1919, and was buried at Henderson, Kentucky, his home town, on November 8. His death, so far as was determined was due to a rapidly developing neoplasm of the lung, and the secondary cause was pulmonary edema. He attended to his work and duties until the last three weeks of his life, which were spent in Phoenix in an attempt to recuperate. Knowing his great love for his favorite association, the Southern Surgical Association, and all of its members, this brief notice is sent to our President for the information of those assembled at this meeting. A complete record of his life and achievement will be furnished for the next issue of the *Transactions*.

It is with extreme pleasure that I call attention to the fact that this is the largest meeting ever held by the Southern Surgical Association. There have been 106 regular Fellows present. In addition, and with much delight, we note the presence of 5 Honorary but very active Fellows viz., Drs. J. W. Long, Lewis S. McMurtry, E. S. Lewis, John D. S. Davis and Isaac S. Stone, making 111 in all. It is the largest meeting by almost a score in the history of the organization; in addition there are about 30 visitors and nearly 40 ladies, who are Fellows *ex-officio*.

The report of the Council is as follows:

At the regular annual meeting of the Council, held in the Hotel Grunewald, New Orleans, December 16, 1919, the following recommendations were agreed upon and ordered to be reported to the Association for adoption:

1. That the resignation of Dr. C. M. Hazen, Richmond, Virginia, be accepted.

2. That the deaths of our Honorary Fellows, Professor Pozzi, of Paris, and Dr. Nicholas Schilling, of Cedar Bayou, Texas; and of our Fellows, Drs. John Young Brown, of St. Louis, Missouri; S. W. Pryor, Chester, South Carolina; Isaac L. Watkins, Montgomery, Alabama; John C. Wyson, Clifton Forge, Virginia, be recorded in the *Transactions*.

3. That the following Fellows be nominated for the Board of Governors of the American College of Surgeons: Lewis C. Morris, S. M. D. Clark, and J. Shelton Horsley.

4. That the following be elected to Fellowship: John Smyth, New Orleans, Louisiana; E. H. Richardson, Baltimore, Maryland; Malvern B. Clopton, St. Louis, Missouri; Charles S. Venable, San Antonio, Texas; Robert G. Le Conte, Philadelphia, Pennsylvania.

5. That the Association meet in 1920 at Hot Springs, Virginia, and that Dr. Hugh H. Trout, Roanoke, Virginia, be asked to act as Chairman of the Committee of Arrangements.

6. That the officers for next year be chosen as follows:

President.—Willard Bartlett, St. Louis, Missouri.

Vice-Presidents.—C. Jeff Miller, New Orleans, Louisiana, and Edward G. Jones, Atlanta, Georgia.

Member of the Council.—J. E. Thompson, Galveston, Texas, to succeed Dr. J. W. Long, whose term has expired.

Respectfully submitted,
JOHN WESLEY LONG,
BACON SAUNDERS,
WILLIAM D. HAGGARD,
LEWIS S. MCMURTRY, *pro tem.*,
RUDOLPH MATAS, *pro tem.*
Members of the Council.

THE PRESIDENT.—What disposition do you wish to make of the report of the Council?

DR. R. S. HILL.—I move that the report be adopted as read. Seconded and carried.

THE PRESIDENT.—The next in order is the report of the Auditing Committee.

DR. LEWIS C. MORRIS.—Your Auditing Committee, composed of Drs. Black, Scott and myself, begs to report that it finds the books of the Secretary and Treasurer correct.

THE PRESIDENT.—What do you wish to do with this report?

It was moved that the report be adopted. Seconded and carried.

Dr. Joseph Ransohoff, Cincinnati, Ohio, moved that a vote of thanks be extended to the Local Committee of Arrangements for the entertainment given the Association and that cordial thanks be extended to the management of the Grunewald Hotel

for the excellent accommodations provided for the meeting. Seconded and carried.

THE PRESIDENT.—I think it is in order now to install our new President, and I will ask Dr. McMurtry and Dr. Haggard to escort him to the platform.

Dr. Thompson, in introducing his successor, said: I take very great pleasure in introducing to you my successor, Dr. Willard Bartlett, of St. Louis, not that he needs any introduction to the members of this Association. He has been a constant and faithful attendant at these meetings and has contributed always everything that he has possessed in a personal and scientific manner to our sessions. Those of you who know him know how genial he is, and you further know that he is lacking only in one quality, and that is hair.

In handing over the insignia of office to Dr. Bartlett, I will ask him to be merciful; to think always before striking the table with this gavel, and never under any circumstances to steal one minute from anyone who is discussing a paper, and to be particularly merciful to the man who gets up to discuss a paper who is afflicted with a vicious circle.

Dr. Bartlett, in accepting the presidency, said: Gentlemen of the Southern Surgical Association: One may perhaps pardon a certain highly personal point of view at a time like this. One may even confess to a degree of elation when the highest position which comes within his professional horizon is in sight for him; but he will not proceed very far along that line of thought until he becomes the subject of highly mixed emotions, because it won't be long until, if he is at all philosophical in his tendencies, he stops to realize that the only real pleasure in the possession of a coveted gift comes in the satisfaction of having merited it. That reflection, bad as it is, would not be fatal if one did not at this time in retrospect see the presidents before him of the last thirty-three years down to his gifted predecessor. I believe you will agree with the speaker of the moment that contemplation of this sort makes one feel a little bit like a crown prince, who acquires the throne during his tender years.

Much more could be said, but I believe I am to have another opportunity next year, so I will content myself with merely stating that the only adequately cheering reflection at this time, the only off-setting reflection, is the genuine satisfaction, which

one takes and for which one must express unbounded gratification, that he has an opportunity to place at the disposal of this group of men his lifework in a constructive way. Gentlemen, I thank you from the bottom of my heart.

32. "Surgical Drainage from a Biological Standpoint," by Dr. J. Shelton Horsley, Richmond, Virginia. This paper was discussed by Drs. Cullen, Ransohoff, Thompson, Danna, Bryan, Primrose, Bartlett, Jackson, and in closing by the essayist.

33. "My Observations on the Carrel-Dakin Treatment of Infections," by Dr. E. Dunbar Newell, Chattanooga, Tennessee. Discussed by Dr. G. B. Rhodes.

On motion the Association adjourned until 2 P. M.

Afternoon Session. The Association reassembled at 2 P.M., and was called to order by the President.

34. "The Result and Feasibility of Treating Lymphangiomata with Injections of Boiling Water," by Dr. Francis Reder, St. Louis, Missouri. Discussed by Dr. Ransohoff.

35. "Autogenous Bone Grafting for Repair in Fractures of the Long Bones," by Dr. Frank Martin, Baltimore, Maryland Discussed by Drs. Hodgson, Carothers, Judd, Ransohoff and in closing by the essayist.

36. "Oxycephaly," by Dr. Stephen H. Watts, Charlottesville, Virginia. Discussed by Dr. Kerr.

37. "An Efficient Treatment for Carbuncle," by Dr. A. C. Scott, Temple, Texas, which was discussed by Drs. Carothers, McGlannan, Ransohoff, and in closing by the essayist.

38. "Blastomycosis, with Report of a Case Dying from Abscess of the Brain," by Dr. John T. Moore, Houston, Texas.

As there was no further business, scientific or otherwise, to come before the meeting, on motion the Association then adjourned to meet at Hot Springs, Virginia, December 14, 15 and 16, 1920.

HUBERT A. ROYSTER, M.D.,
Secretary.

PRESIDENT'S ADDRESS

SURGERY AND EMBRYOLOGY

By James E. Thompson, M.D.
Galveston, Texas

No greater compliment can be paid to any man than to be raised to a position of trust and eminence by his peers. I therefore, first of all, thank the Fellows of the Southern Surgical Association for the great honor they have conferred on me by electing me to the presidential chair in this Association, whose 225 Fellows stand for everything that is best in modern surgery.

It now becomes my sad duty to announce to you the deaths of five of our Fellows: Nicholas Schilling, of Cedar Bayou, Texas, one of the Founders; John Young Brown, of St. Louis, Mo., president in 1913; Stewart Wylie Pryor, of Chester, S. C.; Isaac Lafayette Watkins, of Montgomery, Ala.; John C. Wysor, of Clifton Forge, Va. We bemoan their loss and send to their bereaved relatives messages of deepest sympathy.

I stand before you today with mingled feelings of humility, because I alone know how little I deserve the distinction and of pride at having my name placed among those distinguished predecessors whose reputation will last as long as American surgery is remembered. In my most ambitious moments I never aspired to the honor, and, like all favors unsought, it carries the greater distinction.

My election as a Fellow of this Association dates from the Louisville meeting, in the year 1892. It was my good fortune to be sent there by the Regents of the University of Texas as their representative to attend a meeting of the Southern Medical Colleges, to consider the advisability of raising the standard of medical education in the South. Coming from an institution only one year old, absolutely without prestige, history or reputation, and myself its representative, very young, unknown in America, with my professional reputation yet to make, I attended the meeting with many misgivings and some fear, all of which I found to be totally unfounded, since my reception turned out to be of a most flattering character. I was treated with the greatest consideration by everybody whom it was my good fortune to meet, and my recollections of the personalities of these gentlemen are singularly vivid even after the lapse of so many years. To meet such notables as Yandell, Howard Kelly, McMurtry, W. D. Haggard, Sr., McFadden Gaston, Cartledge, Palmer, Wathen, Rodman, Roberts, and others equally distinguished, was an event that has since been reckoned as one of the milestones of my life. I was at an impressionable age, very much of a hero-worshipper and profoundly flattered at my favorable reception by men who at that time were the backbone of the surgical profession of the South. It is always pleasant to think of the meeting as one where I made my professional debut and where friendships began that have continued to the present time.

I can never repay the debt I owe to this society. In spite of considerable shortcomings as to attendance on the meetings some years back, I have during the past twelve years been a very regular attendant. Even during the period of my neglect the *Transactions* were read by me from cover to cover and were a never-failing source of pleasure and profit. For many years I have sat through the sessions, listening to papers and discussions equal to those in any similar society in the world. I have now reached a point where I look forward to the meetings as a source of such educational stimulus that attendance has become an urgent necessity, for they constitute a sort of intellectual

exchange where new ideas and thoughts, after being subjected to searching criticism, and winnowed, as it were, like grain from the chaff, are bestowed upon us with a bountiful hand. Each year when I receive the program of the meeting I am astonished at its range and dismayed by its profundity. Usually there is one paper, or at the most two, that I feel capable of discussing feebly. The rest are so technical and exclusive that it is vanity to pretend for a moment to more than a superficial knowledge of their scope. It has often occurred to me that my mental perplexity must be shared by most of the Fellows, and that I am not alone in this feeling of hopelessness and inability to keep abreast of the advances in surgery. In my own particular case I have become resigned and look upon it as a healthy symptom. Just as "a cold nose is a sign of a healthy pup," so must I interpret my rigors of apprehension when faced with the terrors of one of our programs. I have promised my better-self, during moments of introspection, to cease attending the meetings of this society whenever I feel thoroughly at home with the subject-matter of any program that reaches me. Until that time comes, and with it mental decay, I expect to occupy a chair at every annual meeting.

I have chosen as the title of my address, "Surgery and Embryology." A year ago our worthy Secretary suggested to me that an address of a scientific character would be agreeable, and I assented. The choice of a title was one of great difficulty. In selecting a subject to present to you I had to choose between one of special or esoteric and one of general interest. My choice of the latter was not made without some misgivings, because I was afraid I might be tempted to abuse your generosity and ramble too far afield. More especially was I apprehensive that in my enthusiasm I might choose for detailed consideration phases of the vast subject full of fascination for myself, but deadly boring to my hearers.

As the title is rather alarming, I promise you in advance that I shall not become encyclopedic, but shall confine my remarks to the description of a few abnormalities of great surgical importance. To this end I shall consider the subject

under two heads: (1) a general survey of some abnormalities in the abdomen, and (2) a somewhat detailed description of the cysts in the neck arising from remains of the branchial clefts, with special reference to the origin of ranula.

Human anatomy, viewed merely from the standpoint of bones, muscles, nerves, viscera, etc., is perhaps one of the most difficult of all studies to learn and retain in one's memory. If taught without comparison between the anatomical structures of man and those of the other vertebrates the study becomes a dull grind and a hopeless presentation of facts without meaning or purpose. But if the student has a clear understanding of the stages by which the organs of man have reached their adult development, and the marvellous changes and modifications that have taken place in them during the transition of man from the lower vertebrate types, the subject becomes one of absorbing interest. From such a standpoint each structure and organ has its own history, which is inseparably connected with that of similar structures in the lower animals; and the parallel histories of these organs in each species form, as it were, a contemporary history of every species through all eternity. Viewed from this aspect human anatomy becomes a fascinating and romantic study, in which reason is added to mere fact and purpose takes the place of coincidence.

A few notable examples of the interdependence of human and comparative anatomy and embryology may be cited as illustrations. In amphibia the right and left aortic arches both persist; in birds the right aortic arch alone survives; in man and other mammals the left survives.

The complex relationships of the genital glands and their ducts and the permanent kidney and ureter cannot be mastered intelligently without accurate knowledge of the adult forms in the lower vertebrates. The Wolffian body and duct signify mere names unless they are studied in amphibia and fishes, in which the Wolffian body forms the functional kidney and its duct serves as the functional ureter in both sexes and the seminal duct in the male. In reptiles and the higher vertebrates the Wolffian body is a temporary embryonic structure

which never exercises any renal function. Parts of it persist permanently as excretory tubules for the male genital glands. The rest disappears in both sexes, although vestigial remains are found in both the male (the hydatid of Morgagni, vas aberrans and the organ of Giraldés) and in the female (epoöphoron and paroöphoron), which are occasionally responsible for pathological conditions, such as cysts of the testicle or broad ligament. The Wolffian duct functionates in the male as the vas deferens, but disappears in the female. Occasionally it persists as the duct of Gärtner and may be responsible for cysts on the posterior surface of the uterus and the wall of the vagina.

The permanent kidney of the higher vertebrates is a new structure (the metanephros), which is developed in the sacral region of the embryo in connection with a diverticulum from the lower end of the Wolffian duct (renal bud). With the growth upward of the renal bud the metanephros ascends to its permanent position in the lumbar region. Failure to ascend is responsible for pelvic or iliac ectopia. Failure to ascend caused by fusion of the right and left glands produces the horseshoe kidney.

The genital glands are developed on the inner aspect of the Wolffian bodies and are situated at the anterior end of the celom. In the male the gland tubules connect with those of the Wolffian body and so open into the Wolffian duct, which becomes the vas deferens. In the female the ova are extruded into the celom and eventually pass into the open end of a tube, the Müllerian duct, which in the lower vertebrates passes downward and opens separately into the cloaca. In mammals the upper end of each tube forms the Fallopian tube. The lower parts fuse together and form the uterus and vagina. Failure in union is responsible for bifid uterus and double vagina (v. sepatum). The descent of the genital glands is noticed early. The testicle is in the iliac fossa in the third month, and in the eighth month it leaves the inguinal canal. The descent of the ovaries is usually arrested normally at the pelvic brim. Both organs may be retained in their early embryonic positions.

Retention of the testis is so common that it may be passed without comment; that of the ovary is a rarer anomaly. One interesting example came under my observation some time ago. While operating on a patient supposed to be suffering from appendical colic, I discovered a band running diagonally across the front of the ileocolic junction. It passed from the right renal region downward and medially into the pelvis. Below it was traced into the right upper cornu of the uterus, with which it blended. Above it passed into a hard, rock-like mass which lay in front of the right kidney. The pelvic organs and intestines were fixed together by adhesions of a peculiar consistency, unlike those produced by an infective peritonitis, which made it impossible to separate the uterus from the gut. I was unable to inspect the left uterine cornu or feel the left ovary or tube. The right cornu I denuded and found that the band of tissue, which felt like a tube, was continuous with it. I was unable to discover a right ovary in this situation. While handling the band it was felt to consist of two fairly distinct portions or cords. Through a second incision parallel with the upper right costal margin we cut down on the hard, rock-like substance. This was found to lie in a mass of adhesions situated in front of the right kidney and to the outer side of the hepatic flexure of the colon. After enucleation it was seen to consist of calcified material to which the upper end of the double band previously described was attached. Suspecting that the calcified mass represented an undescended ovary and that the band represented the Fallopian tube, the specimen was excised and examined carefully. Microscopic examination of the band showed two separate tubes, one of which probably represented the Fallopian tube and the other a persistent Wolffian duct. Photomicrographs of the sections, with legends attached, are appended in confirmation of this statement (Figs. 1 and 2). We have not yet been able to discover the exact origin of the calcified mass, but the supposition is that it represents a calcified ovary.

Cases of imperforate anus, with openings between the lower end of the rectum and the urethra (uro-genital sinus) in the

male or the vulva in the female, can hardly be explained without reference to adult forms in the lower vertebrates, because we are unable to find evidence at any stage in the development of the human embryo that the rectum opens at any of these sites. If, however, we study the adult conditions of amphibia, reptiles, monotremes and marsupials, we find the rectum opening in situations which tally precisely with those of the abnormal openings occurring in man. One of the commonest malformations, namely, in which the anus is imperforate and the rectum opens into the vulva (in the female) is almost an exact reproduction of the adult stage of marsupials.

The inference is clear that the organs of man have passed through these stages in reaching their present development, but that in some manner the steps of the process have been suppressed in the development of the embryo.

Nothing can be more fascinating than a study in which truths stand suddenly revealed by a new arrangement and correlation of observations which individually are of mere academic interest. It is like finding new beauties in a picture or hidden meanings in a beloved book. Happy is the man who sees and understands, and unhappy he who is blind to the path beyond the open door, whose windows remain always barred to the universe and to whom, like Peter Bell:

> "A primrose by a river's brim
> A yellow primrose was to him,
> And it was nothing more."
>
> "The soft blue sky did never melt
> Into his heart; he never felt
> The witchery of the soft blue sky"

Most human beings are born singularly perfect and apparently free from anatomical abnormalities. Yet a tour of observation through any dissecting room will reveal anomalies present in most of the bodies on the tables. Of all the structures in the body the arteries show the greatest number and variety of anomalies, a fact which can be probably explained by the ease by which the collateral channels can enlarge if parent trunks

are obstructed. Those affecting arteries most commonly ligated we may pass over because they are well known to the teachers of operative surgery and consequently to surgeons in general. Others, particularly those occurring in the visceral arteries, occur more frequently and are less known. Variations in the origin and distribution of the mesenteric arteries are very common. The right colic artery is frequently absent, its place being taken by a branch from the ileocolic or the middle colic; or the middle colic may be represented by a branch from the right colic. The arteries of the liver are subject to great variation. The left lobe of the liver is often supplied entirely by a branch of the left gastric artery. In these cases the main hepatic trunk derived from the celiac axis is distributed exclusively to the right lobe and the gall-bladder. Occasionally the left lobe receives its blood supply from the main hepatic trunk, aided at times by a branch from the left gastric, while the right lobe and gall-ladder receive their blood supply from a large trunk which takes its origin from a neighboring artery, usually from the superior mesenteric. This trunk usually passes behind the portal vein in its course to the liver.

Some time ago I made a tour of the dissecting room with Professor H. O. Knight for the purpose of examining the abdominal cavities of twenty-three cadavers which were open to inspection at one time. Although the number of bodies inspected was small and the abnormalities were comparatively few, they form an interesting list, which I shall present to you in tabular form:

Arrested rotation of colon	1 case
Presence of Meckel's diverticulum	0 "
Absence of vermiform appendix	1 "
Abnormalities in hepatic vessels	9 "
Low position of kidneys (lower pole below crest of ilium)	2 "
Jejunum, commencement of, passing to the right	3 "
Congenital absence of spleen	1 "

In such a small number of bodies the list is very instructive, and, with the exception of the congenital absence of the spleen,

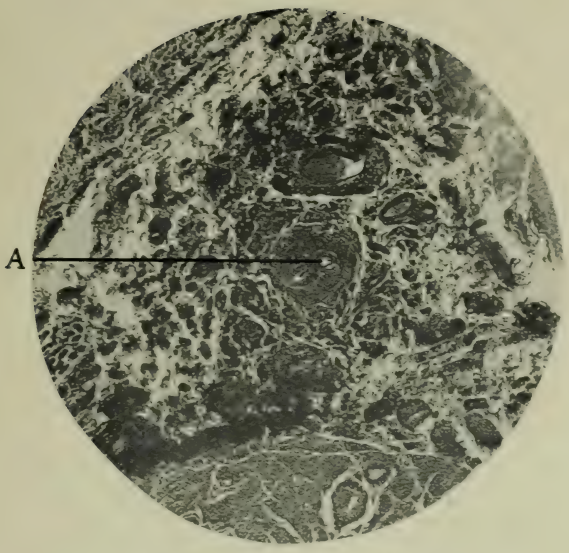

FIG. 1.—Section of band of tissue showing Muellerian duct. *A*, cross-section of duct which here is double.

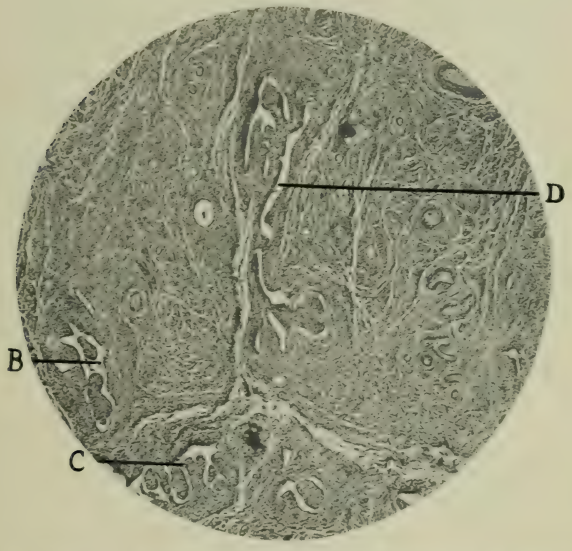

FIG. 2.—Section of band of tissue, showing vestigial Wolffian body. *B*, *C*, *D*, point to Wolffian tubules.

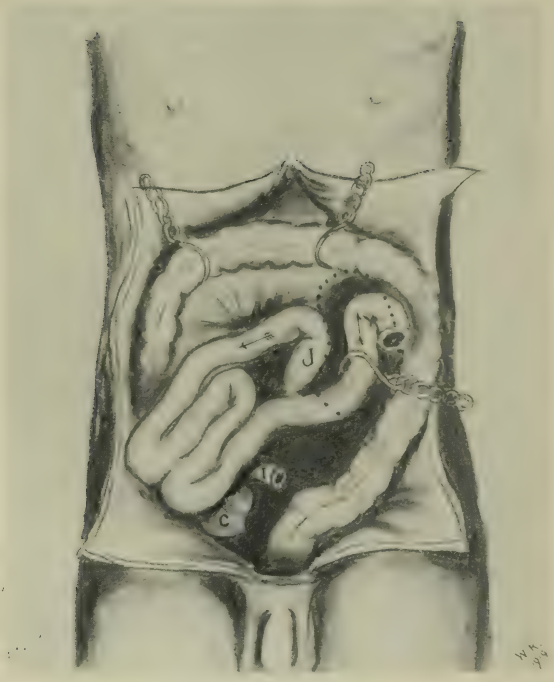

FIG. 3.—The above figure shows a condition frequently seen when the first few feet of the jejunum pass to the right. *J*, is on the commencement of the jejunum. The arrows indicate the direction of intestinal flow.

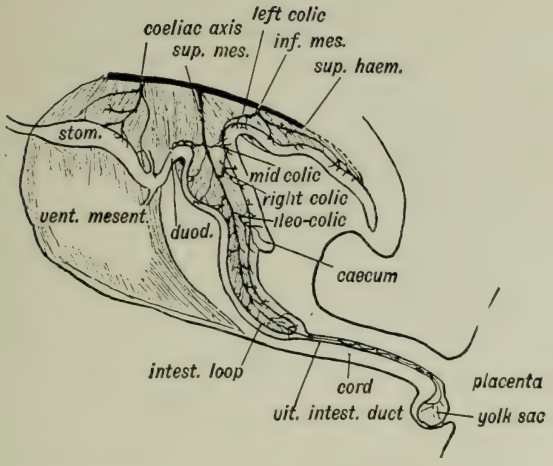

FIG. 4.—Human alimentary canal in the fifth week of embryonic life. (Diagram from Keith.)

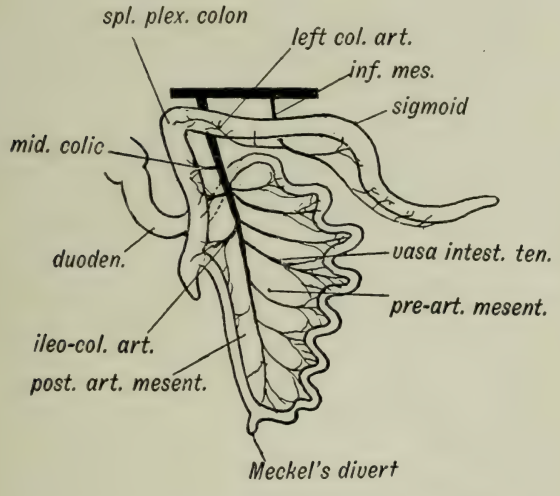

FIG. 5.—Human alimentary canal in the third month of embryonic life. (Diagram from Keith.)

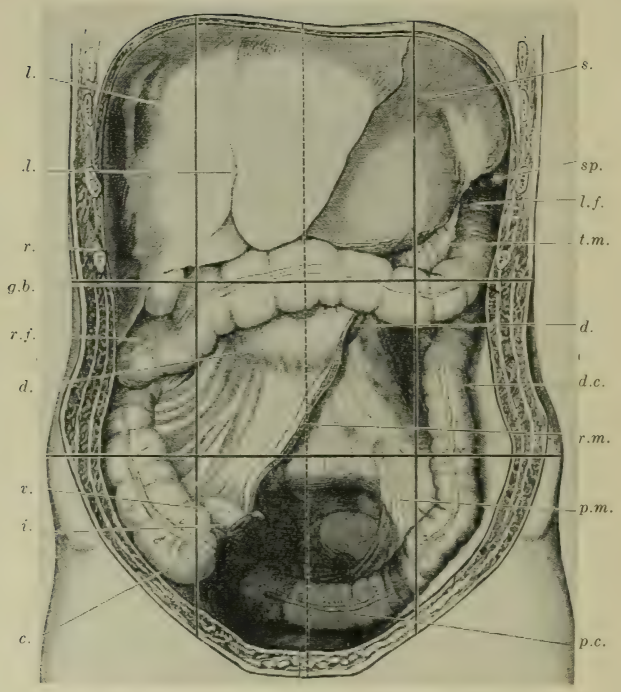

FIG. 6.—*l.*, liver; *f.l.*, attachment of falciform ligament; *r.*, tenth rib; *g.b.*, gall-bladder; *r.f.*, right flexure of the colon (O. T. hepatic flexure); *d.*, duodenum; *v.*, vermiform process; *i.*, ileum; *c.*, cecum; *s.*, stomach; *sp.*, spleen, anterior angle; *l.f.*, left flexure of the colon (O. T. splenic flexure); *t.m.*, transverse mesocolon; *d.c.*, descending colon; *r.m.*, root of mesentery, cut; *p.m.*, pelvic mesentery; *p.c.*, pelvic colon. (From Cunningham.)

it is probably a fair average of the yearly findings. The arrested rotation of the colon affected the lower end of the ascending colon and ileocecal junction. This part of the bowel had failed to rotate and to unite to the peritoneal surface of the flank. The ileum entered the cecum from the right side. As Meckel's diverticulum is said to be present in 2 per cent. of bodies, and one specimen was found last year in eighteen dissected bodies, its absence is not surprising. A dissection of the cases with abnormal hepatic arteries showed three cases in which the right hepatic artery came from the superior mesenteric. In every case the cystic artery arose from the right hepatic. The cases in which the first two feet or so of the jejunum passed to the right are worth notice. For a number of years past Professor William Keiller has called my attention to this point. It has a special bearing on the technic of the no-loop operation of the gastrojejunostomy as practised in the so-called Mayo operation, and would call for a reversal of the manner of placing clamps on the jejunum (Fig. 3).

This list of abnormalities, small as it is, gives an insight into the possibilities that may confront a surgeon who is exploring, not twenty-three abdominal cavities, but hundreds each year.

Every operator expects the viscera to occupy normal positions, and, if he fails to find the organ he is searching for, he hunts for it where previous experience has taught him he is most likely to find it. If he has been carefully trained in embryology he will know beforehand where to look and what to observe; but if not, he will probably begin a ramble over the greater part of the abdominal cavity, which may end disastrously for the patient. Cases of misplaced vermiform appendix and arrested rotation of the cecum fall in this category and are responsible for some of the most puzzling conditions.

Intestinal abnormalities, being more frequently met with than those of the other abdominal viscera, will receive almost exclusive attention in this communication. They result from arrest of or failure in the rotation of the colon, or, to speak more correctly, the intestinal loop, at an early period of

embryonic life, a fault which is responsible for all the cases of misplaced cecum and vermiform appendix. Starting with the lower portion of the left hypochondrium as the probable embryonic position of the cecum, it may be found arrested at any point between this and the right iliac fossa along the line of its normal descent, which follows approximately that of the normal transverse and descending colon. It is seen so frequently just below the level of the gall-bladder that a differential diagnosis between appendicitis and cholecystitis is often a matter of considerable difficulty. I have frequently seen it to the left of and above the level of the umbilicus (Fig. 7). In one of my cases fatal typhoid perforation occurred in a cecum situated here. In another case during an exploratory laparotomy I found the cecum in this position embedded in a rolled-up mass of omentum, so thick that it could not be unravelled. The large intestine coursed downward from it as a perfectly straight tube, and, to my surprise, it passed over the right brim of the pelvis. There was practically no sigmoid loop. The left flank contained no large intestine.

In order to understand these abnormalities it is necessary to visualize clearly the steps of the rotation and the changes in the respective positions of the large and small intestines during the process.

In the fifth week of embryonic life the shape of the alimentary canal is that represented in Fig 4. The foregut is firmly fixed by both dorsal and ventral mesenteries. The midgut and hindguts are slung up to the posterior body wall by their dorsal mesenteries only. The ventral mesenteries have disappeared. The mesentery of the midgut is long and the intestinal tube forms a long U-loop, from the convex end of which the vitelline duct passes through the umbilical opening to the yolk sac. Where the limbs of the U-loop join the fore- and hindguts there are acute bends, and the gut has little mobility above and below these points. The U-loop, which is supplied by the superior mesenteric artery, is not able to move very freely in a lateral direction, because its apex is fixed by the attachment of the vitelline duct to the umbilicus. It is, however, able to

rotate around its base where the two limbs of the U are close together. After the fifth week the midgut increases in length very rapidly, far outstripping the other divisions of the alimentary canal. Its mesentery becomes fan-shaped and capacious, except at the base of the loop, where the limbs of the U join the rest of the gut. Here the mesentery is reduced to a narrow isthmus (duodenocolic isthmus), through which the superior mesenteric artery passes. At the beginning of the third month the U-shaped loop twists round on this isthmus from right to left (viewed from in front in the opposite direction to the hands of a watch) (Fig. 5). By this twist the part of the hindgut near the limb of the U gets carried upward and to the left toward the splenic region, where it adheres and forms the splenic flexure of the colon. The rest of the colon proximal to this swings over the front of the abdominal cavity from left to right, becoming attached to the structures on the posterior body wall along a line extending from the left to the right kidney and thence down to the right iliac fossa. As the twist affects both limbs of the U-loop at the isthmus the proximal part of the midgut entering the loop is carried to the left behind the colon, and the rest of the loop twists in the same direction; so that it comes to lie free in the abdominal cavity below the colon with its mesenteric faces partly reversed, the anterior face of the mesentery representing the right side of the dorsal mesentery and the posterior face its left side. At the same time the superior mesenteric artery comes to lie in front of the commencement of this part of the gut and marks the line of separation between the duodenum and jejunum. The effect of this twist is to carry the right side of the dorsal mesentery of the duodenum against the posterior body wall, where it becomes attached. It will be evident on reflection that the rotation of the U-shaped loop of the intestine, followed by its adhesion to the posterior body wall, is responsible for the obliteration of the lateral spaces of the body cavity on both sides of the dorsal mesentery of the upper end of the foregut (second and third parts of the duodenum). The splenic flexure of the colon comes to lie in front of the left kidney, and the

hepatic over the right, while the ascending and descending colons lie in the right and left flanks. Peritoneal adhesions form between the colon and its mesentery and the posterior body wall which fix the left face of the gut and mesentery to the parietal peritoneum. The right face of the mesocolon becomes the anterior face, which lies in the concavity of the free colonic loop. It is continuous along the line of the ileocolic artery with the right face of the mesentery of the small intestine. The process of fixation is probably exactly analogous to that occurring in inflammatory processes. In most cadavers irregular lines of union, leaving numerous pockets and crevices, can be seen along the outer sides of the ascending and descending colon. At the splenic flexure the union is very firm, being strengthened by a special band of tissue which passes from the diaphragm and the tip of the eleventh rib to the gut (costocolic ligament). Proximal to this the fixation is less substantial. The attachment of the transverse mesocolon to the pancreas and the second part of the duodenum is comparatively loose, and the long mesentery allows great mobility to the transverse colon. The hepatic flexure is more firmly fixed to the tissues in front of the right kidney, but there is no strong ligament on this side analogous to that fixing the splenic flexure. The ascending colon and cecum unite fairly firmly with the posterior body wall below the right kidney. A careful examination of Fig. 6 shows the anatomical relationships of the colon when complete rotation and fixation have taken place. The termination of the duodenum shows through the root of the transverse mesocolon. The small intestines have been removed, and the cut edge of the mesentery is exposed along the line of the ileocolic artery. The ascending and transverse mesocolon form a roughly triangular area bounded by the ascending and transverse colon and the line of the ileocolic artery. The exposed face of the mesocolon is the original right face of the mesentery, the unrotated gut. Behind the termination of the duodenum lies the fossa duodenojejunalis, the extent and shape of which vary within great limits. Hernia into this fossa is occasionally met with. If the hernia passes

to the left (the commonest variety) the inferior mesenteric vein and left colic artery lie in front of the neck of the sac. If the hernia passes to the right the superior mesenteric artery lies in front of the neck. A successful case was operated on in the Sealy Hospital clinic, where the hernia passed to the right. At least half the small intestine was found in the sac. The extent of the sac corresponded to a space roughly triangular in outline, bounded by the lines of the ascending colon and hepatic flexure, by the curve of the duodenum and by the line of the ileocolic artery. The ileocolic junction, cecum, ascending colon, with hepatic flexure and the third part of the duodenum, were spread on the anterior surface of the hernial sac, along its boundaries. The mesocolon and the colic arteries were directly in front.

In order to make the above description still clearer the attached figures taken from Huntington are exhibited:

Fig. 7 shows a condition of complete non-rotation of the intestine. The cecum and appendix are in the embryonic position. The small intestine lies entirely on the right side of the abdominal cavity, and the exposed face of its mesentery is the original left face. The part of the colon corresponding to the splenic flexure is well fixed and reasonably high. Between it and the cecum the colon is thrown into redundant folds. Between it and the rectum the descending colon passes downward as a straight tube.

Figs. 8 and 9 show a condition of arrested rotation. The cecum is at a very low level. The splenic flexure is high up and firmly attached. The small intestine lies entirely on the right side of the abdominal cavity. The exposed face of its mesentery is the original left face. The ileum enters the cecum from right to left. In Fig. 8 the small intestines have been pulled to the right to expose the right side of the mesentery and to show that no adhesions have formed between it and the body wall.

Fig. 10 shows the intestines of tamandua bivittata (the little ant-eater), which exhibits a normal condition of non-rotation.

In all these examples the colon and the duodenum are separated by a narrow neck of mesentery, across which strong

transverse bands of tissue can be seen coursing. This neck represents the duodenocolic isthmus and through it the superior mesenteric artery passes. These conditions are very similar to that present in a human embryo of five weeks. It would seem to be an easy matter for rotation to occur around the narrow duodenocolic isthmus. Some cases of complete volvulus of the small intestine have been described which were probably examples of this. One such occurred in my practice where the whole intestines were twisted from left to right through one and a half turns.

In Fig. 11 we have shown an example of arrested rotation. Here the small intestine has completed its rotation to the left behind the large intestine, and it lies in the left part of the abdominal cavity. Most of the large intestine has also rotated. The ascending colon and ileocolic junction have failed to rotate, and, as a consequence, the terminal part of the ileum lies in the right iliac fossa to the right of the cecum and turning downward to the left to enter it.

In Fig. 12 rotation of the whole intestine is complete except that of the cecum. The ileum opens into its lower border. The iliac fossa is empty.

The two conditions last described are so frequent that scarcely a week passes without one or other being observed in our clinic. They are of little pathological interest, and, apart from the fact that they make the search of the appendix more difficult, are of no consequence.

The remainder of my address will be devoted to the consideration of cysts of the neck of branchial origin, with special reference to the origin of ranula and cysts of the submaxillary region. A satisfactory classification of cysts of the neck is the following:

1. *Lymphatic Cysts* (*Hygroma Colli*). They are usually situated in the lowest part of the posterior triangle of the neck. Not unfrequently they extend under the clavicle into the axillary space. They are derived from the lymphatic sinus (jugular sinus), which is present in the third month of fetal life in the angle between the jugular and subclavian veins.

2. *Thyroglossal Cysts.* They occur in the middle line of the neck either above the hyoid bone in the substance of the tongue (lingual cysts) or below the hyoid bone under the deep fascia. They are derived from the thyroglossal duct, which is formed by a bud of hypoblast which grows downward between the mandibular and pharyngeal parts of the tongue, and which eventually forms the isthmus of the thyroid body and parts of the lateral lobes.

3. *Thyroid Gland Cysts.* They occur in the lateral lobes of the thyroid gland and are derived usually from cystic degeneration in adenomata arising from the gland.

4. *Sequestration Dermoids.* They are usually found in the middle line and are derived from inclusion of areas of epiblast during the fusion of the ventral folds of the embryo.

5. *Branchiogenetic Cysts.* They are derived from persistent remains of the external branchial depressions of the embryo.

6. *Parastic Cysts.* Echinococcus, etc.

Branchiogenetic Cysts. In order to understand the source of cysts of branchial origin it is necessary to have a clear idea of the structure and ultimate fate of the branchial arches and clefts in the human embryo. In the third week of fetal life evidences of branchial arches are visible in the human embryo. The pharyngeal region resembles that of an adult fish. Both have branchial arches, but whereas in fishes the arches are separated by clefts, in the human embryo they are separated by depressions. The depressions, which are visible on the outer aspect of the neck and the inner aspect of the pharynx, are separated by a membrane which is covered on its outer side by epiblast and on its inner side by hypoblast. In the normal course of events this membrane never disappears in mammals. In the rare instances in which it is perforated a complete cleft results which may persist in the adult as a branchial fistula. The growth of the region of the neck in a human embryo is so rapid that by the end of the sixth week all external evidence of the branchial arches and depressions has vanished.

As the fate of the branchial arches and clefts is of prime

importance in explaining the origin of the cysts in question, a short description of their anatomy is essential.

Branchial Arches. There are probably six arches in all, of which four can be recognized on the surface of the neck. The two anterior are connected with the bony framework of the skeleton by their posterior extremities, but the four posterior have no such connections. Each arch contains (1) a basis of cartilage, (2) a vascular arch, (3) nerves, (4) muscle elements. The first arch is the mandibular. Its cartilaginous basis (Meckel's cartilage) forms the foundation of the lower jaw, although the greater part disappears. The posterior end persists as the malleus, the anterior end as the part of the lower jaw which carries the incisor teeth. The nerve of this arch is the third division of the fifth. The artery of the arch disappears, but the origin of the external maxillary artery (facial) marks the place where it arose from the ventral aorta (external carotid). The second arch is the hyoid. Its posterior end persists as the stapes, the middle portion as the styloid process and stylohyoid ligament and the lowest part as the lesser cornu of the hyoid bone. The nerve of this arch is represented by the facial and auditory (seventh and eighth). The artery of the arch disappears, but the lingual artery marks the place where it arose from the ventral aorta. The third arch is represented in the adult by the great cornu and body of the hyoid bone. Its nerve is the glossopharyngeal (ninth). The artery of the arch persists as the first part of the internal carotid. The superior thyroid artery arises from its place of origin from the ventral aorta. The fourth arch is represented in the adult by the upper part of the thyroid cartilage. Its nerve is the superior laryngeal branch of the vagus. The vascular arch is represented on the right side by the first part of the subclavian artery and on the left side by that part of the arch of the aorta between the origin of the left carotid and the spot where the ductus arteriosus enters it. The fifth arch is represented in the adult by the lower portion of the thyroid cartilage. Its nerve is the inferior laryngeal branch of the vagus. The sixth arch is represented in the adult by the cricoid and arytenoid cartil-

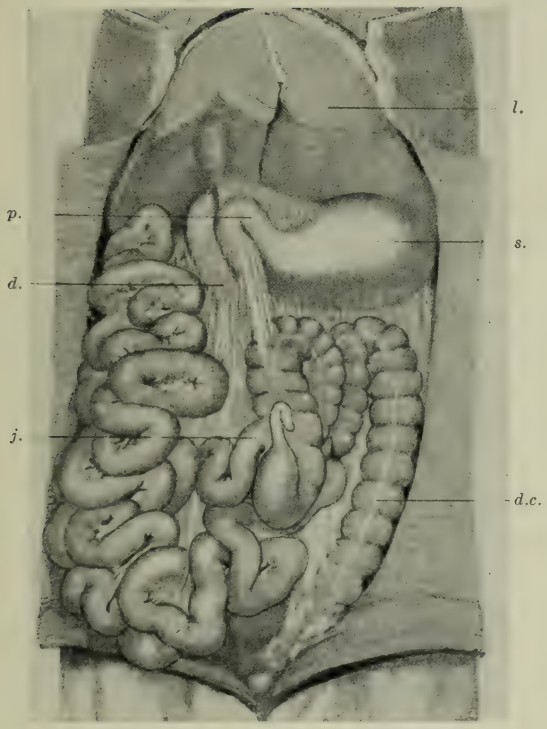

Fig. 7.—Complete non-rotation of intestine. *p.*, pylorus; *d.*, duodenum; *j.*, ileocolic junction; *l.*, liver; *s.*, stomach; *d.c.*, descending colon. (From Huntington.)

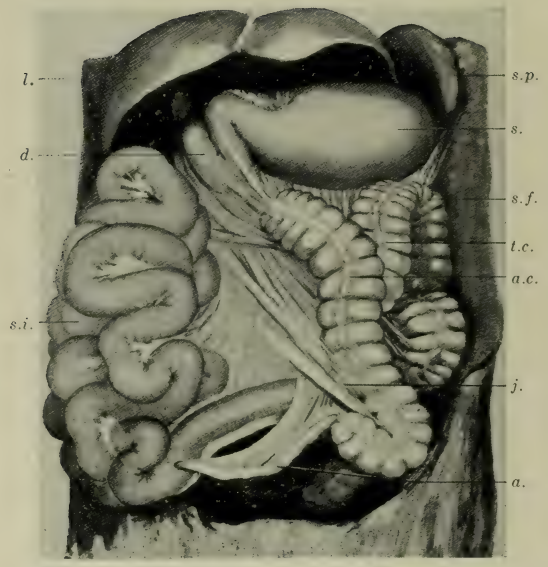

FIG. 8.—Arrested rotation of intestine. *l.*, liver; *d.*, duodenum; *s.i.*, small intestine; *sp.*, spleen; *s.*, stomach; *s.f.*, splenic flexure; *t.c.*, segment corresponding to transverse colon; *a.c.*, ascending colon; *j.*, ileocolic junction; *a.*, appendix. (From Huntington.)

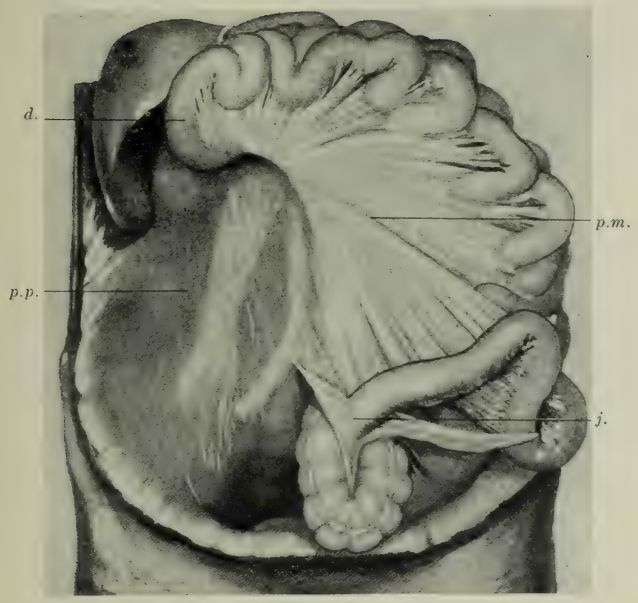

Fig. 9.—Same case as Fig. 8, showing small intestines pulled to the left side. *d.*, duodenum; *p.p.*, primitive parietal peritoneum of right lumbar region; *p.m.*, primitive mesentery common to small intestine and non-rotated colon; *j.*, ileocolic junction, dorsal surface. (From Huntington.)

FIG. 10.—Intestines of Tamandua bivittata (little ant eater), showing a normal condition of non-rotation. *p.*, pylorus; *d.*, duodenojejunal transition; *s.i.*, small intestine forming efferent limb of intestinal loop; *j.*, ileocolic junction; *g.o.*, great omentum turned up; *sp.*, spleen; *a.*, superior mesenteric artery in duodenocolic isthmus; *c.*, colon at termination of afferent limb of intestinal loop; *p.c.*, colon—proximal segment forming afferent limb of intestinal loop. (From Huntington.)

FIG. 11.—Arrested rotation of intestine. *l.*, liver; *i.*, terminal ileum; *g.o.*, great omentum. (From Huntington.)

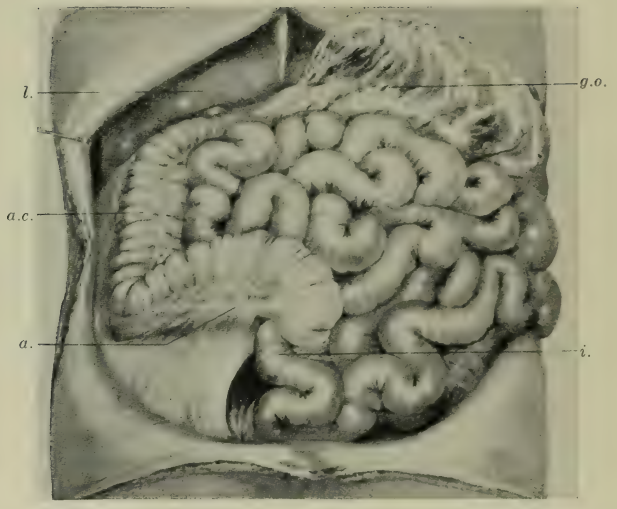

FIG. 12.—Arrested rotation of intestine. *l.*, liver; *a.c.*, ascending colon; *a.*, appendix adherent to lateral aspect of ascending colon and to iliac parietal peritoneum; *g.o.*, great omentum; *i.*, terminal ileum. (From Huntington.)

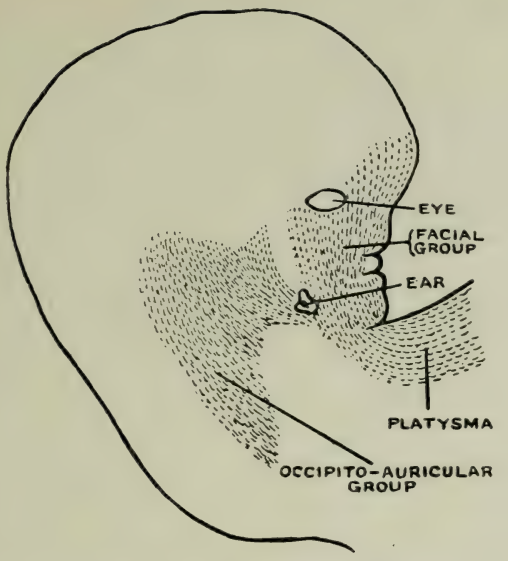

Fig. 13.—Migration of platysma. (From Keith.)

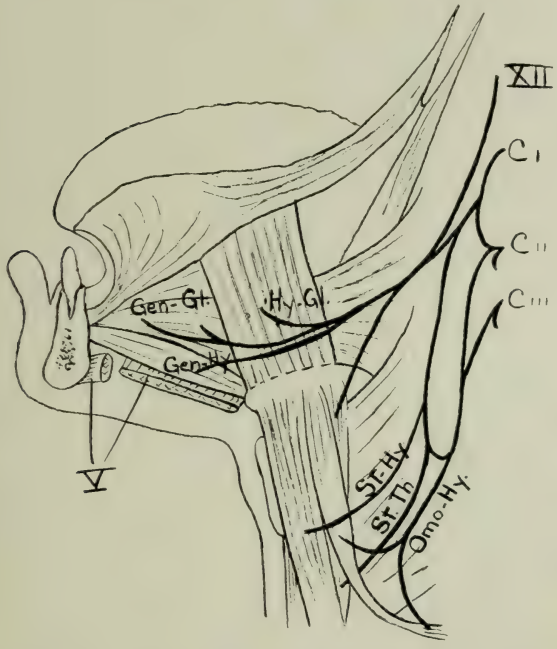

Fig. 14.—Migration of muscles of hypoglossal group.

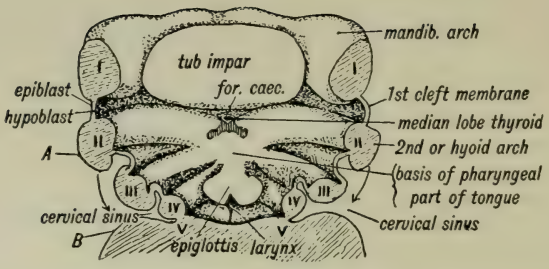

Fig. 15.—View of the inner aspect of the pharynx, showing the anterior ends of the branchial arches and the internal branchial cleft depression. (From Keith.)

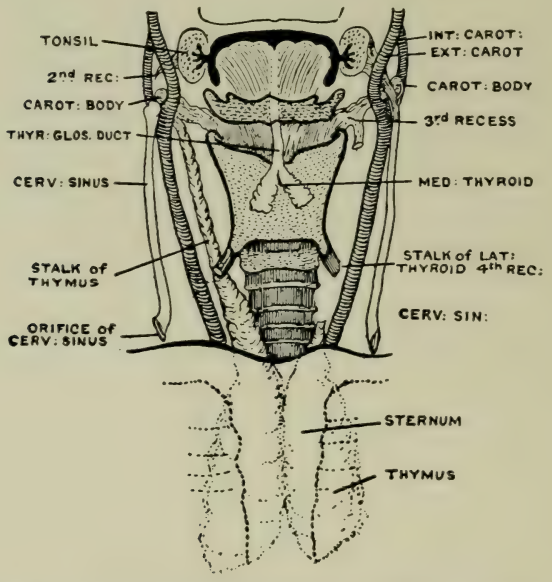

Fig. 16.—Diagram, showing in schematic fashion the cervical sinus and the organs developed in connection with the inner branchial cleft recesses. (From Keith.)

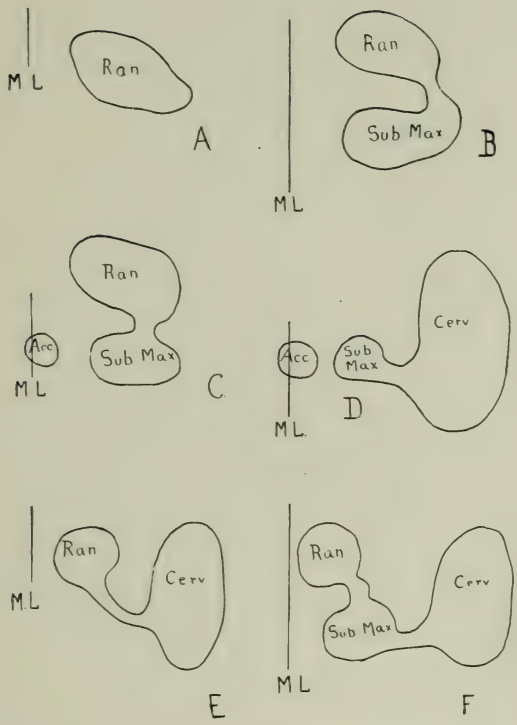

FIG. 17.—Types of cysts found in lingual submaxillary cervical regions. For convenience they have all been placed on the left side. *ml*, middle line of body; *ran*, ranula; *sub-max*, submaxillary cyst; *cerv.*, cervical cyst; *acc*, accessory cyst.

ages and the cartilaginous rings of the trachea and bronchi. Its nerve is the inferior laryngeal branch of the vagus. (The vascular arches of the fifth arch probably disappear early. That of the sixth persists on the left side as part of the right pulmonary artery and ductus arteriosus; on the right side it shares in the formation of the right pulmonary artery.)

The muscles of the arches deserve special consideration. Their embryonic origin is identified by their nerve supply. From the first arch (fifth nerve) are derived the muscles of mastication, the tensor palati and tympani, the mylohyoid and the anterior belly of the digastric; from the second arch (seventh nerve) the stapedius, the stylohyoid, the posterior belly of the digastric, all the muscles of facial expression and the platysma; from the third arch (ninth nerve) the stylopharyngeus and some of the muscles of the soft palate; from the fourth arch (superior laryngeal nerve) some of the muscles of the soft palate and the constrictors of the pharynx and the cricothyroid; from the fifth arch (inferior laryngeal nerve) the intrinsic muscles of the larynx.

With the increase in length of the neck of the embryo the arches descend and carry their muscular and nervous elements with them. The descent of the muscles is, however, not always quite regular, for we find in the soft palate one of the muscles (the tensor palati) supplied by the nerve of the first arch, and the rest supplied by a plexus (pharyngeal) in which the nerves of the third and fourth arches mingle. The greatest irregularity is seen in the muscles derived from the second arch (hyoid). A remarkable muscular bud makes its appearance, which grows upward into the face and scalp and downward into the lower portion of the neck (Fig. 13). From it the occipitofrontalis, all the muscles of expression and the platysma are derived. Branches of the seventh nerve are carried with the muscles.

Another muscular migration that further disturbs the orderly arrangement of parts comes from the seventh, eighth and ninth body segments, which are situated behind those supplied by the tenth and eleventh nerves. These segments are

supplied by the twelfth nerve (hypoglossal). The path and extent of this migration are clearly shown by the course of the hypoglossal nerve and the situation of the muscles supplied by it (Fig. 14). It may be divided into two parts: an upper (lingual), which forms the geniohyoid, geniohyoglossus, hyoglossus and all the intrinsic muscles of the tongue, and a lower (infrahyoid), which forms the depressors of the hyoid bone. One of the muscles, namely, the omohyoid, passes down as far as the scapula. The lingual bud, into which the upper part of this muscular mass penetrates, is developed from two separate parts: an anterior (buccal), which arises from the anterior ends of the first visceral arch, and a posterior (pharyngeal), which arises from the anterior ends of the second and third arches. The hypoblast of these buds retains its original nerve supply. That to its anterior part, which forms the anterior two-thirds of the tongue, comes from the nerve to the first arch (fifth lingual), while that to the posterior, which forms the posterior third of the organ, is derived from the nerves of the second and third arches and is represented by the chorda tympani (seventh) and the glossopharyngeal (ninth). The resulting organ offers an interesting picture of a muscular mass innervated by the twelfth nerve and covered by mucous membrane supplied by the fifth, seventh and ninth nerves.

Branchial Clefts. Four cleft depressions can be recognized in the embryo. The first cleft (hyomandibular) persists. Its external depression is represented by the external auditory meatus. In connection with the internal depression the Eustachian tube and tympanum are developed. The membrana tympani represents probably the cleft membrane. The second, third and fourth clefts disappear and usually leave no traces. In a very young embryo (fourth week) the second arch grows downward and covers the third and fourth and comes into contact with the body wall behind the fifth. By this growth, which is analogous to that forming the gill cover in fishes, the orifices of the second, third and fourth cleft depressions are covered up and a space is shut off into which they open. This is called the cervical sinus (Fig. 15). It usually disappears.

If it persists a cyst may result. The cyst may open externally on the neck, and the usual situation of the opening is in the lower part of the neck along the anterior border of the sternomastoid muscle. Occasionally the cyst opens internally into the pharynx. When this occurs the opening into the pharynx usually passes through the membrane of the second cleft. When both internal and external openings are present a long fistulous tract lined by epithelium stretches between the surface of the neck and the cavity of the pharynx (Fig. 16). If the tract is dissected out it always passes above the fork of the carotids, *i.e.*, above the third branchial arch. The internal opening is in the tonsillar recess (second cleft depression). The external opening varies in position. It is always along the anterior border of the sternomastoid, but it may be anywhere between the cricothyroid space and just above the sternoclavicular joint.

It is difficult to determine the part played by the cervical sinus in the formation of branchial cysts. It is more than probable that it is responsible for the cysts and fistulæ met with in the lower part of the neck below the level of the thyroid cartilage. But it is more difficult to understand how cysts situated high up in the neck under cover of the parotid gland can be derived from a cavity which primarily covers the second, third and fourth clefts. If, however, we admit the possibility of such a cyst being carried from a lower to a higher level by muscular agency in the rearrangement of the muscular planes of the neck, the problem is easily solved. After careful deliberation I have adopted this theory as a satisfactory explanation of mucous cysts of the upper cervical region. I shall include ranula in this category, and, while I hesitate to state dogmatically that true ranula always has its origin in branchiogentic rests, I am able to present strong clinical and pathological evidence in support of this contention.

In 1906 I reported two cases of congenital cysts of the neck, with mucous contents, which I believed were derived from branchial clefts*. In both cases the anatomical relationships

* Texas State Journal of Medicine, December, 1906.

of the cyst with the deep structures of the neck were identical, and at the same time so peculiar and definite that they negatived mere coincidence as to origin. I have since seen another case with features so identical that a common description will serve for all three. The cysts lay in the upper part of the neck, beneath the deep cervical fascia, under cover of the upper part of the sternomastoid muscle and the lower part of the parotid gland. In none of the cases did it extend into the neck lower than the hyoid bone. In all the cases there was a narrow communication between the main body of the cyst and a smiliar cyst in the submaxillary region. In three of the cases the submaxillary portion of the cyst communicated around the posterior border of the mylohyoid muscle with a cyst in the floor of the mouth underneath the tongue (ranula). In the one case there was no ranula, but an accessory cyst was found medial to the submaxillary portion of the cyst. The cases are represented diagramatically in Fig. 17.

The following description of one of the cases (Case 1) associated with ranula is taken almost verbatim from my original report. It is entirely satisfactory even at the present time, and my subsequent experience has corroborated the accuracy of the original anatomical description:

The first case was a girl, L. S., aged fifteen, who was sent to me by Dr. Nixon, of Gonzales, for diagnosis and treatment in March, 1904. The family history showed nothing pertinent to the case. Personal history was of little consequence. She had suffered from most of the diseases of infancy except measles. She had always been strong and healthy.

Present Disease. In November, 1902, she first noticed a small swelling underneath the tongue. It gave no trouble, but worried her. She consulted a physician, who incised it and evacuated a little white mucus. After a time it reappeared, and although evacuated from time to time the mucus reaccumulated. A seton was inserted, but with no effect. In January, 1903, she consulted Dr. Herff, who pronounced it a ranula, and attempted its removal. The condition was better for a time. Her mother kept the opening into the cyst patent until

May, 1903. In September, 1903, her condition was worse again and the swelling involved the tissues under the jaw; the tongue was badly swollen and the upper part of the anterior triangle of the neck was bulged. Dr. Herff drained it again, with temporary improvement. In October it swelled up again and the parotid gland became more prominent. A rubber drainage tube was used and retained for seven weeks. In January the swelling reappeared and intermittently increased and decreased in volume until March 1, 1904, when she consulted me. The condition was the following: Under the right side of the tongue a typical ranula, the size of a walnut, could be seen, on the surface of which appeared a scar passing horizontally from right to left. Wharton's duct had been divided and the secretion of the right submaxillary gland exuded from its cut proximal end. The tongue was pushed upward and to the left, and speech was indistinct. Below the body of the jaw the upper part of the submaxillary region bulged slightly, this swelling being apparently continuous with that underneath the tongue. The parotid gland was a shade more prominent on the right side than on the left.

On March 4 I operated on the ranula, and attacked it at first within the mouth. Finding that complete removal would be impossible by the intrabuccal method, I opened the submaxillary region, by the incision usually used to tie the lingual artery. The ranula was situated for the most part above the mylohyoid muscle, but a process extended down around the hinder border into the submaxillary triangle almost as far as the hyoid bone. To reach it the submaxillary salivary gland was dislocated upward. While dissecting the lower part of the cyst away mucus was seen to ooze from the posterior part of the wound. A director, passed toward this point, suddenly penetrated along a narrow channel into a large cavity, from which mucus exuded. The channel was dilated and the exploring finger passed into the cavity. It was quite large, and at its highest point the tip of the finger was just able to feel the boundary wall. The boundaries were the following: Above it reached the base of the skull, the bony irregularities of which

could be distinctly felt; behind, the anterior border of the mastoid process and the whole length of the styloid process could be felt so distinctly that the velvety cyst wall appeared as thin as the thinnest rubber finger cot; mesially, the bodies of the upper cervical vertebræ were distinctly made out and the carotid artery could be felt beating under the posterior lining of the cyst; anteriorly and internally were the tonsil and pharynx; externally was the ramus of the lower jaw covered by the internal pterygoid muscle, also the parotid gland; below the cyst terminated in a rounded outline, the lowest part being about the level of the body of the hyoid bone.

The cases that have been observed since have conformed in every detail to the description given above as regards the anatomical situation of the deep cervical part of the cyst. There has been considerable variation in the way they connected with the cysts in the submaxillary region or with those underneath the tongue. They are represented with fair accuracy in Fig. 17, *d, e* and *f*. Microscopic examination of the lining wall of the cysts was rather unsatisfactory. Most of the sections showed no epithelium. When epithelium was found it occurred as a single layer like that lining the interior of a bloodvessel. The connective tissue beneath the endothelium was a thick layer of dense fibrous tissue, with large lymph spaces. It was remarkably free from cellular elements.

It is strange that after careful search through the literature of the subject I have been unable to secure histories of cases of ranula and branchiogenetic cysts that correspond exactly with those just described. Their anatomical boundaries are so definite and consistent as to negative mere coincidence, and to support the view that they are probably of frequent occurrence.

It seems a far cry from simple cases of ranula to the complicated cysts that we have just described. If, however, a careful analysis is made of the topography of cysts in the floor of the mouth and submaxillary region that most surgeons would admit without hesitation as ranulæ, we can supply the missing parts of the puzzle. In Fig. 17, *a, b, c, d, e* and *f*, six varieties of cysts are pictured, each of which is an accurate representa-

tion of an individual case verified by operation. The explanation is given in the attached legends. The inference that each one of these varieties represents isolated and scattered parts of a mother cyst that has been subjected to fragmentation, and displacement is irresistible. No satisfactory evidence has ever been advanced that ranula arises from mucous glands in the floor of the mouth or from the salivary glands, and the theory of its development in a bursa (Fleischmann's) has still less to support it.

Therefore, after careful deliberation, I advance the theory that ranula, submaxillary cysts and deep cervical cysts of the types presented are derived from vestigial remains of the branchial clefts; that the primary cyst is derived from the cervical sinus or from the parts of the cervical sinus in relation to the external depression of the second cleft; that the cyst is carried from its original position by the shifting of muscles during the formation of the neck, by which part of the cyst (deep cervical) is carried up to the base of the skull by the palate muscles, which are derived from the third and fourth arches and part carried into the submaxillary region and tongue by the migration of the muscles of the hypoglossal group.

The theory is suggested, with considerable hesitation, because I feel that it is supported by a somewhat slender array of clinical observations; but its simplicity is so apparent, and simplicity is so often the greatest attribute of truth, that I venture to submit it for your consideration and criticism.

THE INJECTION OF THE GASSERIAN GANGLION FOR NEURALGIA AND OTHER CONDITIONS

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This subject, which appeared rather frequently in medical literature a few years ago, is at the present time less often met with, notwithstanding that its range of usefulness has been widened, and among the few who have perfected its technic, much more accurately and safely carried out. The majority of the profession have but a vague idea of the methods of injection commonly in use, and but a limited number ever attempt their practice; among those who do there are many otherwise well qualified and competent men who use the method imperfectly and often hazardously.

It is to correct these errors and encourage a more general understanding of the subject, and particularly to call attention to its widened field of usefulness, that this paper is written. And it is for this reason that I beg your indulgence if I enter into details of what may appear inconsequential points.

The proper execution of the technic of this injection demands a thorough knowledge of the osteology of the parts involved, also of the soft parts below the floor of the skull and within the skull adjacent to the foramen ovale, and the effects upon these internal parts of the alcohol injected. This information is only acquired by arduous study and extensive clinical experience. The method most commonly used and the one practised by the writer almost exclusively is the Härtel route. This has, as its external landmarks, the point of entrance of

the needle, which is within an area on the cheek opposite the three upper molar teeth; in many cases these teeth have been extracted in efforts to obtain relief, but their former position is easily determined. As the foramen ovale is a fixed point behind and above this area on the cheek, when the needle is entered opposite the first molar it naturally has to follow a more oblique course and traverse a greater depth through the soft parts than when entered opposite the last molar tooth, which is more nearly under the foramen ovale. As the needle which is used is long and slender, its point can be more accurately manipulated when advanced through the shorter route, and the difficulties encountered are often less, as the route passes through some muscle, the contraction of which serves to deviate its point, and this is more marked in the longer route.

Occasionally an ossified tendon or well-marked tendinous digitation of one of the muscles, a spicule of bone or an unusually developed osseous process, add to the difficulty. These are all usually lessened or more easily overcome by the more direct route opposite the last molar tooth; occasionally, however, these obstacles are so situated that it is necessary to withdraw the needle and reënter it at a more anterior point, but it is doubtful if the foramen ovale can be successfully reached from a point much farther forward than the first molar tooth. As the last molar tooth is opposite the anterior edge of the ramus of the jaw the writer determines the point of entrance of the needle by depressing a finger into the cheek just in front of the ramus of the jaw on a level with the molar teeth. This ensures entering the needle at the most posterior point.

Having selected the proper point on the cheek an intradermal wheal is produced in the skin with a small needle; any ordinarily used local anesthetic will answer for the purpose, Schleich No. 1, novocain ½ per cent., or aposthesin ½ per cent., with a few drops of adrenalin. The long needle, 19 gauge, 3½ inches long, with short, sharply bevelled point accurately fitted to a small syringe, well tested so that there will be no leaking, is now used. Any small syringe which answers the purpose will do and is preferred to a large one, as it is more

easily handled, and should fit the needle by a slip joint, so that it can be easily detached for refilling with the local anesthetic as the needle is being gradually advanced. The long needle is entered through the skin, when a finger is placed within the mouth to guide the needle backward between the mucous membrane and the ramus of the jaw to guard against the needle entering the mouth, injecting the local anesthetic gradually as the needle is being advanced backward and upward.

Two external landmarks are now made use of. Viewed from in front the plane along which the needle is passing should run through the pupil of the eye; viewed from the side this plane should pass through the tubercle at the base of the zygomatic process. These two points, with the point of entrance of the needle, form the three external landmarks. The pupil and zygomatic tubercle should constantly be kept in mind and constantly watched as the needle is being advanced. After the needle has passed the inner surface of the ramus of the jaw and has been protected from puncturing the mucous membrane the finger is removed from the mouth and the entire attention devoted to the external landmarks and the progress of the needle inward, backward and upward. The anesthetic solution should be steadily injected as the needle is being advanced, detaching the syringe from time to time for refilling. As the deeper parts are reached the needle is almost directly in the course of the branches of the third division of the fifth nerve, and as the foramen ovale is reached it is necessary to transfix the nerve trunk in entering the foramen.

In these positions it is necessary to use the anesthetic solution somewhat more freely and to delay the further progress of the needle until the solution has had time to thoroughly saturate the nerve tissue.

As has been shown the foramen ovale is remarkably constant in its position, both in relation to the articular tubercle at the base of the zygoma as well as to the plane passing through the pupil of the eye. The writer has found it desirable instead of aiming the needle directly at the recognized position of the foramen ovale to direct it to a point just in front, about one-

quarter inch, but carefully keeping it on the plane with the pupil of the eye. This is found advantageous for the following reasons: while the position of the foramen ovale is constant, it is very easy in directing the needle from the cheek to this point to misjudge the direction and pass the needle too far beyond, and if one is not thoroughly familiar with the feel of the bony parts in this posterior area, the operator might flounder about with the needle, wasting time and producing unnecessary trauma to parts from which mischief might result; these dangers will be spoken of later. Having reached the under surface of the skull in front of the foramen it is found to be smooth and with a gradual downward and backward slope. This is the under surface of the great wing of the sphenoid bone, just to the outer side of the base of the pterygoid process; to this surface is attached the pterygoid muscle.

The downward and backward slope of this surface is quite noticeable. As the needle is gradually advanced backward instead of the needle progressively advancing to greater and greater depth, as it should do if the surface were level, the depth is found not to increase, and in a few cases where the slight concavity at the base of the pterygoid bone is more marked and the slight ridge of bone passing from the base of the pterygoid process in front of the foramen ovale more decided, the actual depth traversed by the needle may grow less until its point slips over this ridge. The foramen ovale now lies directly behind, and if the proper sagittal axis has been maintained (that is, on a line with the pupil of the eye) the needle is felt to slip over this ridge of bone and into the foramen, the edges of which are usually felt as it slips within. If the proper pupillary axis has not been maintained the needle may advance backward over this ridge of bone to the outer side of the foramen. It is less likely to advance backward on the inner side as the laterally projecting edge of the pterygoid process is usually on about the same anteroposterior plane as the inner edge of the foramen; rarely is it slightly internal to it.

If the needle has passed this point without entering the

foramen and advances to the area just posterior, its point comes in contact with the rough and irregular area around the Eustachian canal and farther to the rear and internally the jugular foramen. The contact of the needle-point with this surface is in marked contrast with the hard and smooth surface in front of the foramen; here the surface is rough, irregular and gritty, and feels not unlike a piece of rough pumice stone. Should the needle miss the foramen in its backward passage and come in contact with the rough posterior surface no further progress backward should be attempted, but the needle should be made to retrace its course forward but on a slightly lateral plane. Should the needle reach the smooth under surface of the sphenoid without coming in contact with the foramen, work backward again on a slightly lateral plane. By following this plan successful results will be obtained except in those few rare cases in which anatomical difficulties make the injection impossible. As it is necessary to pass through the edge of the pterygoid muscle in reaching the base of the skull, contractions of the muscle may deviate the point of the needle, and in advancing backward through muscle tissue it may at times be found necessary to completely withdraw the needle from the muscle before thrusting it forward again. The tensor palati may similarly interfere, particularly its tendinous portion, which is sometimes ossified, but the difficulty is overcome in a similar way. All progress of the needle along the surface of the skull should be by short gentle thrusts by slightly withdrawing it, changing its direction and advancing again.

This general plan of procedure has been found by the writer to be most satisfactory, much more so than by trying to aim directly for the foramen; for should you miss you are in doubt as to the direction in which the foramen lies in relation to the needle-point, and there is often much aimless floundering about in taking chance shots. The foramen ovale varies much in size and shape, at times being quite large, permitting the free and easy passage of the needle without its coming in contact with the bony edges; in such cases the exact depth at which the needle left the level of the skull is not known and much

care must be exercised not to advance the needle too deeply. Once within the skull an important point to determine is the depth of the needle. The point may very rarely by manipulation be brought in contact with the bony surface on the inner side of the floor of the skull, but that gives no idea of its depth. The best method is by injecting a local anesthetic, and for this purpose, as well as when anesthetizing the trunks of the nerve or ganglion, it is well to use a slightly stronger solution, say 1 or 2 per cent. novocain or ½ to 1 per cent. cocain. The advantage of the use of stronger solutions here is that a much smaller volume can be used which exerts a maximum effect at the first point of contact with the nerve tissue. For this purpose a few drops are all that may be necessary, whereas if a larger volume of a weaker solution is made use of it may flow backward and anesthetize branches beyond the point of the needle and mislead one as to his exact position. When the injection is made for surgical purposes this diffusion of the anesthetic is desirable, and is often the preferred way of proceeding; but when used for purposes of alcoholic injection it is very undesirable; for here the object is to concentrate the action of the alcohol to the branches of the nerve involved in the neuralgic disturbance and to use the minimum quantity necessary.

In the majority of cases the foramen is small enough to be easily felt by the needle as it passes through, and in some cases it is so contracted as to require a little steady pressure upon the needle to make it enter. In these latter cases it is easy to determine the depth the needle travels after entering the foramen. The skull with its periosteum around the foramen is about three-sixteenths of an inch thick and the lower surface of the ganglion is about one-quarter of an inch above the foramen; consequently the needle should travel to a depth of seven-sixteenths, or about one-half inch from the external opening of the foramen, to the under surface of the ganglion. The depth to which the needle is being advanced is further kept under control by the use of the stronger anesthetic solution, which is made use of, once the needle is within the foramen, to make its further progress painless.

Possible Complications Outside the Skull. The most likely and frequent occurrence is hemorrhage. Blood is obtained in appreciable quantity in a large percentage of cases. The track of the needle passes across the course of the internal maxillary artery and vein, the artery pursuing a tortuous course and the vein often forming an extensive plexus. The middle meningeal artery is given off in this position and ascends to the foramen spinosum; this foramen is occasionally fused with the foramen ovale, forming one large opening. With this vascular supply directly in the path of the needle it is not surprising that blood is frequently met with, and unless the proper technic is followed is often overlooked by the operator. The mere puncturing of a vessel in this position is of no consequence, and when using the proper kind of needle will bleed little if any. I have never seen a hematoma develop which could be detected by external examination. The objection to entering a vessel here is not in the trauma inflicted but that with the needle-point within the lumen any anesthetic is carried away within the vessel and its local influence lost; and also that the solution, if in sufficient quantity and injected within a vein, may have some disturbing effect upon the patient. To avoid this occurrence, as the needle is being advanced and just before any injection is made, slight aspiration is exerted by the syringe, and, if blood is encountered, the needle is slightly withdrawn and again tested before an injection is made. Once the area is well under the influence of the adrenalin in the anesthetic solution the vessels become so contracted as to offer no further trouble.

Puncture of the Eustachian Canal. When the needle has been advanced too far backward behind the foramen ovale the Eustachian canal is directly in its path, and when entered by the needle produces a sharp pain radiating into the internal ear. No damage results if the needle is withdrawn, but should an injection be made the solution can flow down the canal into the pharynx and backward into the internal ear and may cause complications. In careful hands this accident should not occur. The jugular foramen lies too far posterior to be liable to injury

unless all rules have been neglected, and, if only punctured, no damage is likely to result; but if entered and the needle roughly handled its walls may be lacerated or the carotid artery lying in contact with the vein could be sufficiently injured to produce an arteriovenous aneurysm.

Complications Within the Skull. Within the skull two complications are possible. The cavernous sinus or the internal carotid artery which lies within it may be wounded. If this is done by a straight puncture and with the needle of the small caliber recommended, no harm will result should it be immediately withdrawn; but if the needle is coarse, or rough manipulation resorted to, serious damage to the sinus or an arteriovenous aneurysm may result. Should the needle be advanced too deeply it will be passed through the dura and enter the brain; and while a small puncture here may not be serious, should the alcohol be injected, much damage and after-consequences may result.

Immediately after penetrating the dura, and before entering the brain, the needle has to pass through the subarachnoid space. Here cerebrospinal fluid can be withdrawn if gentle aspiration is made upon the syringe, which should always be the rule at short distances when advancing the needle in this injection.

The obtaining of the fluid is proof that the needle is following the right course, but has advanced slightly too far. It should now be slightly withdrawn, gently aspirating all the time, until a point is reached where no fluid is obtained; the needle will then be just below the dura and within or in contact with the ganglion, and in the proper position for the injection of the alcohol. When the cerebrospinal fluid is obtained a test can be made to determine its characteristics, but this is unnecessary, as it is only from the subarachnoid space that clear fluid is obtained within the skull; the remote possibility of a cyst being encountered need hardly be considered. The anesthetic solution once injected cannot be aspirated by the needle, as it immediately becomes distributed in the cellular tissue, which is everywhere sufficiently abundant to enmesh it. If the cere-

brospinal fluid is examined it will be found that it is alkaline; of a specific gravity of 1002 to 1004; does not coagulate on boiling and reduces a copper solution.

Prof. Matas, to whom we are much indebted in this field for his pioneer work, has laid stress on the obtaining of this fluid as proof that the needle is travelling in the right direction and tries to reach this space as a check to the proper depth, withdrawing the needle to just below the dura for the injection. While this method is absolutely accurate and establishes beyond any doubt the location of the point of the needle, I have found in patients in whom this test was resorted to that they often had more headache, vomiting and other symptoms, which persisted longer than in those cases in which the fluid was not withdrawn. I have accordingly preferred to determine the proper depth of the needle by the use of small quantities of anesthetic solution. When the injection is made for surgical purposes it is not necessary to get in actual contact with the ganglion, as once within the foramen ovale any fluid injected will flow backward and downward (the patient lying down) to the ganglion. It cannot flow back along the course of the needle, as the foramen ovale is closed with soft tissues, which it was necessary for the needle to puncture in entering. It is, however, desirable to use as small a quantity of fluid as possible, and, for this reason, we should reach a point quite near the ganglion; for any excess of fluid will flow backward along the roots of the ganglion and enter the cerebrospinal space through the porous trigemini, which is just in front of the pons. Any fluid escaping here may reach the medulla in sufficient strength to make itself felt on the respiratory center. This happened to me once, when operating for malignancy of the superior maxilla, respirations becoming shallow and slow with the patient cyanosed but perfectly comfortable. With the respiratory center anesthetized he did not feel the demands of the system for oxygen and may have stopped breathing entirely had we let him. We asked him to take a few deep breaths, which he did, when the cyanosis at once disappeared, to reappear again when he would stop. We accordingly kept him breathing by remind-

ing him of it until this effect passed off; there were no other symptoms of toxic action and the pulse did not appear to be noticeably affected. Novocain was the drug used; about 15 or 20 drops of a 1 per cent. solution had been injected.

THE ALCOHOL INJECTION. The needle-point having reached the desired position in contact with the ganglion and the local anesthetic having exerted its full influence as shown by complete peripheral anesthesia of the entire side of the face, the syringe is carefully detached without moving the needle and filled with the required amount of alcohol. As originally recommended by Schlosser, and as ordinarily practised, about 1 c.c. of 80 per cent. alcohol is used, this strength of alcohol having been found sufficient to destroy nerve tissue when injected alone. When the tissues have been previouly injected with a local anesthetic this increase of fluid so far dilutes the alcohol that 80 per cent. is insufficient. I accordingly use 95 per cent. and have never found it necessary to exceed 7 minims, and, if the injection is accurately placed, 5 minims is often sufficient. With proper anesthesia no pain is felt when the alcohol is injected. This should always be done slowly, taking from one-half to one minute; the only effect observed is that the peripheral anesthesia may become somewhat more profound and occasionally the pupil of the eye may be seen to dilate and in some few cases the face becomes flushed and vomiting occurs. If the nerve has been insufficiently anesthetized before the alcohol is injected this pain is always more pronounced, and in such cases the alcohol should be more slowly injected, allowing sufficient time for each two or three drops to exert its full destructive influence and all pain to subside before more is injected. When the alcohol is used without the preliminary anesthetic injections this pain is of an intense burning character and radiates along the distribution of the nerve; and, in the case of the ganglion, it often feels like an electric shock in the side of the head, subsiding in a few seconds, followed by a progressively increasing anesthesia in the peripheral parts as more and more is injected. It is only possible to determine the exact amount necessary when injecting an

unanesthetized nerve when the resulting peripheral anesthesia serves as a guide and the injections continued within the above limits until the peripheral anesthesia becomes permanent and complete. When injecting an anesthetized nerve it may occasionally be found necessary to repeat the injection later, more often with the ganglion, should the resulting anesthesia be incomplete; this plan is usually to be preferred rather than take the risk of serious after-effects if the injection be too liberally made. Besides, very few patients will permit an alcoholic injection without some preliminary anesthesia, and the necessity for making the injection quite accurately requires that the patient be absolutely quiet, and this can be best secured when the procedure is painless. Should it be found that the injection has been insufficient to control the pain, as shown by a return of the attacks or the return of sensation to the peripheral parts, the injection can be repeated next day or after a few days' delay, as preferred.

In about one-third of my cases a second injection has been necessary. In these cases there is usually just enough anesthesia to make both the passage of the needle and the injection of the alcohol after the ganglion has been reached painless; if any local anesthetic is needed it is very little. At the second injection rarely more than 5 drops of 95 per cent. alcohol are needed; this is very slowly injected, one or two drops at a time. If the peripheral anesthesia is incomplete, this can be taken as a guide and the alcohol injection stopped when this becomes complete. As alcohol acts very promptly on nerve tissue a delay of a minute is sufficient to determine its full action. Cases injected in this way under local anesthesia suffer absolutely no pain from the injection, but it is the usual experience that the manipulations of the parts excite a neuralgic paroxysm until the anesthesia has advanced far enough to keep these under control.

I have had one case in which there was unquestionably a very satisfactory injection in which a few mild attacks of pain occurred at intervals for ten days following, after which there was no further recurrence. It is possible that in this case the

alcohol did not penetrate completely through the nerve tissue, but that the destructive process once started finally involved the entire structure. With few exceptions all patients who are to receive an alcohol injection of the ganglion are admitted to the hospital and kept in bed so as to be under better control and observation; this confinement is usually from one to three days. Before dismissing out-of-town patients a tarsorrhaphy is done on the lids of the injected side; these sutures may be removed after reaching home.

It has been found that chromium sulphate exerts a curative influence on the keratitis which sometimes follows these injections. Accordingly I have been giving all of my recent cases a 4-grain tablet of this remedy three times daily as a prophylactic, advising its use for about one month. Whether this last procedure has exerted any controlling influence on the eye inflammation or whether the cautious tentative method of injection deserves the credit I am unable to state, but in my last twelve cases there has been no evidence of eye inflammation.

Disturbances Following Alcohol Injection to Ganglion. As the masticator muscles are supplied by the motor root of the fifth nerve these parts are paralyzed following the injection. This causes an inability to masticate on that side; this, however, is not often noticed by the patients, as they have almost invariably accustomed themselves to masticate on the unaffected side. Biting of the tongue and cheek on the anesthetized side often occurs until the patient learns a certain degree of caution in eating. For the above reason, as well as the risk to both eyes, a bilateral alcohol injection should not be lightly undertaken, and if necessary in extreme cases only the absolute minimum quantity should be used, and that accurately placed. In a few cases in which bilateral anesthesia of both ganglions has been used for surgical purposes the jaw and tongue would fall back on the pharynx and cause choking unless it was supported.

Ocular Dangers. As the result of a successful alcohol injection of the ganglion is equivalent to a gasserectomy we have

all the resulting disturbances; namely, anesthesia of the cornea with loss of trophic control and the risk of keratitis. Consequently all patients should be advised of this possibility and it is preferable that an oculist take charge of the eye. The wearing of a collodion shield over the eye immediately following the injection, during the greatest period of danger, is a satisfactory protection; but if complete anesthesia is prolonged beyond one or two weeks a tarsorrhaphy is to be preferred. Under no conditions should the eye be closed with a pad and adhesive plaster, as the lids may open beneath the pad, which then comes in contact with the anesthetized cornea and serious damage may result. Occasionally paralysis of the abducens or nystagmus may occur, and is explained by the alcohol reaching the nerves to the eye in the lateral wall of the cavernous sinus. As a rule these phenomena pass off in a few hours. I have occasionally had double vision persist long enough to require suitable glasses for its correction. Transient deafness and facial paresis are explained either by the needle having entered the cerebrospinal space and the injection made beyond the dura, or the alcohol was used in too liberal quantity and flowed back through the porous trigemini, reaching the seventh and eighth nerves on the side of the pons. Such rules as I have given should absolutely prevent this occurrence.

Unusual and Irregular Cases. 1. A man sustained a bilateral dislocation of the inferior maxilla while gaping; it remained unreduced and was finally operated on. Trigeminal neuralgia followed. Repeated attempts to reach the foramen ovale by all routes failed. He was operated on with complete relief; about two years later he had recurrence of pain in the eye.

2. A man had suffered typical attacks for some years and was injected at different times by two of my confrères without relief. I injected him twice, the first time obtaining the usual peripheral anesthetic results before injecting the alcohol; no relief followed. The second time I withdrew cerebrospinal fluid to make certain of the position of the needle; I gradually withdrew the needle until no fluid was obtained when the

alcohol was injected. No relief followed. He was operated on, with complete relief. At operation no anatomical irregularities or other causes were found to explain the failure of the alcohol.

3. A man suffered constant pain in the region of the fifth nerve, right side, but not of neuralgia type. His condition was explained and he accepted the possibilities, willing to do anything to obtain relief. The ganglion was easily reached. A sharp reaction followed the injection—dilated pupil with persistent vomiting for several hours. There was complete anesthesia of the entire side of face and head, but no relief from pain. Five and a half months later he developed a keratitis without previous eye symptoms, which resulted in the loss of sight. When last seen a year later he was a morphin addict. He still had his pain, although there was anesthesia of the peripheral parts. Neurological examination pointed to a central cause.

4. Two cases in which the foramen ovale could not be reached, due to anatomical difficulties, were operated on with relief.

5. A man who some years before had had a fibroma removed from the floor of the orbit and upper part of the antrum had a constant pain deep in his cheek. Injected, with complete relief.

6. A young woman, who had had extensive sinus operations performed, had a persistent pain in the supra- and infra-orbital regions. Injected, with complete relief for several months, when pain returned. Following the injection she developed a keratitis, which left a small opacity on the cornea, which did not appreciably interfere with vision.

7. A woman with constant pain in the cheek and eye, without any demonstrable cause, was injected with relief for four months, when pain returned with diminished severity. In commenting on these irregular cases the pain is often of central or trophic origin, but there are a large number in which much relief can be afforded. The time for the injection should always be selected when the pain is present, and, if the anes-

thetic solution affords relief, it is reasonable to conclude that the alcohol should make that relief permanent; this anesthetic test is quite important. The above cases were all treated in this manner, but the irregular nature of the condition and possibilities should be thoroughly explained to the patient. Care should be taken not to mistake cases of migraine, as this condition is not relieved by injections.

Duration of Results. In the typical cases of tic douloureux, of which I have had about fifty in the last six years, I have had but four to return for a second injection. Of these four the shortest period in which pain returned was fourteen months, the longest period twenty months. The area of anesthesia following these injections gradually diminishes and the motor root usually regains its function after a few months.

Alcohol Injection of the Gasserian Ganglion and its Branches in Cases of Inoperable Malignancy of the Face, Tongue and Jaws. This is an extremely useful and valuable addition to the use of these injections, and, as far as I am aware, hitherto unused for this purpose. Several cases in which I have used it have been very grateful for the marked relief afforded. When the disease is limited to areas supplied by the fifth nerve complete relief is obtained, but when other parts are involved in addition the relief afforded will depend upon the extent of these additional areas. In one case in which the tongue and floor of the mouth were involved on one side the patient suffered excruciating lancinating pains, which ran from the tongue toward the ear, so characteristic of malignancy of these parts; morphin, which had been taken only in moderate doses, had afforded but little relief. Following an alcohol injection of the third division of the fifth nerve at the foramen ovale complete relief was obtained. Death occurred from hemorrhage before additional areas became involved. Another most striking case was malignancy of the antrum and orbit, which had required large doses of morphin for relief of pain. In this case the ganglion was destroyed with alcohol, with complete relief, the patient dying without pain from cachexia and sepsis, and unaware of the true con-

dition of her malady. In these cases injury to the eye is of less concern, as it is often involved or may become so later; but it should be protected and not unnecessarily sacrificed. In involvement of both sides of the face, jaws or tongue it is unwise to do a double alcoholic injection of the ganglion. In these cases the nerve trunks can be dealt with peripheral to the ganglion. From my experience I am convinced when the value of these injections for these conditions is recognized that they will be extensively used, as any method which affords such marked relief is a blessing to these unfortunates in allowing them to retain their mental faculties unclouded by morphin until the disease has advanced to such a point that narcotic oblivion is to be preferred.

DISCUSSION

Dr. Rudolph Matas, New Orleans, Louisiana.[1]—The excellent paper by Dr. Allen should not go by without some discussion, as I am confident that many of us are concerned in the question of relief for trigeminal neuralgia by direct treatment of the Gasserian ganglion, and I feel that the time has come when some statement should be made in regard to the mode of treatment by those who have had sufficient experience to justify a definite expression of opinion.

In the first place, I wish to express my gratification at the splendid work Dr. Allen has done, and is doing, in the field of local and regional anesthesia. I feel a personal pride in Dr. Allen's brilliant accomplishments, as they are the fruition of many years of close association and collaboration in the early experimental period of local and regional anesthesia, when I

[1] Dr. Matas has asked that he be permitted to revise and complete his discussion, which was abruptly brought to a close by the time limit of the debate. This courtesy has been cheerfully granted in view of the importance of the conclusions which, if omitted, would have deprived his message of its most vital significance.—The Secretary.

was planning and trying methods by which to obtain and control the sensibility of the face and head for surgical purposes. As a co-worker and friend, in the development of this phase of surgery, he has my heartiest congratulations. I must also add his share of praise to Dr. Maes, who was particularly diligent and helpful in my earlier studies of the routes of approach to the Gasserian ganglion in the winter of 1912–13.

I regret very much that Dr. Allen did not have an opportunity to state his conclusions in his paper, particularly because, owing to my absence and other circumstances, we have not been able to come together to compare our experiences and harmonize our conclusions.

I need not dwell on the technic. At present, we all agree that the Haertel route, if not the most direct, is the most practical and safest way to the ganglion *via* the foramen ovale. This phase of the question is fully presented by Dr. Allen in his admirable monograph on local and regional anesthesia. Dr. Maes has also elaborated the Haertel procedure in his very able review of the surgical treatment of tic douloureux published in the *International Abstract of Surgery*, October, 1915, which was based upon our cadaveric and clinical studies of this method, in the laboratory of operative surgery, Tulane University, in the winter of 1913.

In December, 1913, I presented a brief summary of my experiences with the Haertel and other methods, at the meeting of this Association at Atlanta, and the present remarks are intended to supplement that report in the light of the experience that has accumulated during the six years that have elapsed since that meeting. This experience has only confirmed the opinion then expressed, that the alcoholization of the Gasserian ganglion by the Haertel and other routes, is a delicate and difficult technical procedure which can be undertaken, with any degree of certainty and security, only by those who have been prepared for its difficulties and dangers by a thorough preliminary knowledge of the anatomy of the base of the skull, and by repeated trials on the human cadaver. The anatomical landmarks and rules laid down by Haertel and others are helpful, but by no means certain guides to the ganglion. I know of scarcely any procedure in which the personal equation and experience of the operator counts for so much. The procedure

is beset with many fallacies which can be discounted only by the physiological proof that the ganglion has been reached, by the loss of sensibility in the territories supplied by the trigeminus when the ganglion is injected with a local anesthetic (novocain, apothesin, etc.). The chief difficulty, after reaching the ganglion, lies in determining the limitation of the injection to the ganglion itself. The danger is in injecting the subarachnoid space by penetrating the dural sheath beyond the ganglion and in this way causing serious and immediate toxic bulbar symptoms which, in one of my earlier experiences, came very near ending in a fatality. Another danger lies in injecting some of the fluid, whether purely anesthetic or alcohol, into the caverous sinus, thus leading to possible thrombus and paralytic disturbance in the distribution of the third, fourth and sixth nerves which lie in the sinus. Another fallacy lies in imperfect injections which affect only the nerve trunk and leave the mass of the ganglion practically untouched by the injected fluid.

To relieve myself of these uncertainties, I finally devised the following technic: (1) Reach the ganglion *via* the foramen ovale, using an extremely fine needle; (2) push the needle slowly through the foramen, until the clear cerebrospinal fluid appears, as in a spinal puncture; (3) withdraw the needle until the fluid ceases to flow; (4) usually the clear fluid is followed by a dripping of dark blood which always suggests that the cavernous sinus has been tapped; (5) the needle is now withdrawn a little further, until the blood flow ceases; (6) at this stage, the physiological test is applied by injecting five to ten drops of a 1 per cent. solution of novocain or apothesin; (7) if the needle is in the ganglion, a general anesthesia of the face, corresponding to the entire territory supplied by the trigeminus, should be demonstrable; (8) when this anesthesia is obtained, inject 1 c.c. of 90 per cent. alcohol; (9) after this, the needle is withdrawn. If this demonstration is not obtained, the injection is only partial and delusive as far as the permanency of its effects is concerned. Alcoholization of the ganglion, when this is complete, is equal to a total gasserectomy, as far as the secondary effects on the eye are concerned. The anesthesia is absolute, and often an intensive herpetic eruption over the distribution of the trigeminal branches confirms the thoroughness of the injection. The chief post-operative danger lies in the neurotrophic keratitis. The

danger to the eye, as in gasserectomy, is proportional to the thoroughness and completeness of the alcoholic injection. The more complete the anesthesia the more certain are destructive corneal changes to follow. It is my conviction that the cornea escapes injury only when the alcoholization of the ganglion is partial and incomplete. Again, these baneful effects on the eye are more certain to follow in the aged and feeble, who contribute the majority of the victims of tic douloureux, and who, on account of their age and infirmities, are usually selected for alcoholization in preference to the intracranial operation.

Consequently, whatever advantages may be claimed for the simplicity and bloodlessness of Gasserian alcoholization are more apparent than real, and are offset and neutralized by the great risk of permanent injury to the eye, varying from a slight hannus or leukoma to a total loss of the cornea, staphyloma, etc. (over 45 per cent. of the cases).

These general conclusions which have followed a large experience in alcoholization of the ganglion since 1913, covering now over 78 cases in the course of six years, have led me to abandon the alcoholic injection of the ganglion in the complete anatomical sense of the term, for partial injections, or better, to limit the alcoholic injection to the individual nerve trunks at their exit from the basal foramina (with modifications for the ophthalmic division), in all cases in which only individual branches are affected, or when the condition of the patient through age and complicating diseases, forbids extensive surgery of any kind.

Under these circumstances the alcoholization of the nerve trunks at the basal foramina, if properly and conscientiously performed, claims a very legitimate field of usefulness, giving comfort and relief for long periods of time with little or no risk. All these procedures, simple as they may appear, require skill which can be acquired only by a knowledge of anatomy.

For all cases of tic douloureux, in which neuralgia is permanently established or confirmed, in which the patients are fit for any surgical operation, I prefer the intrancranial division of the sensory root of the fifth nerve as it enters the ganglion, following the technic of Frazier (with division, not avulsion, of the nerve), which I have found safer and much more satisfactory than gasserectomy. The chief advantage of this procedure is that it gives also the relief that can be obtained by gasserec-

tomy with infinitely less liability to the secondary destructive trophic effects in the cornea than any of the methods of ganglion extirpation. The only protection that I have been able to give patients, who have undergone a complete alcoholization or gasserectomy, after corneal changes have begun, is in the suture of the lids, no other prophylactic treatment having proved effective, and even this is uncertain after the keratitis has begun.

Dr. Urban Maes, New Orleans, Louisiana.—Since Dr. Matas has been kind enough to mention my name in connection with this work, I desire to emphasize two or three points. First of all, I think we should get away from the notion that the injection of the Gasserian ganglion is a minor surgical operation. I think it is an operation of extreme gravity, and one which we should try only after long experience and much experimental work. I tried 400 punctures on the cadaver in order to orientate myself, preliminary to taking up the injection in the living.

The next point I want to speak about is that injection of the Gasserian ganglion is not free from disagreeable and serious complications. In looking over the statistics I find that about 60 per cent. of our cases are prone to acquire a neuroparalytic keratitis, which is not a herpes in any sense of the word, but it is a distinct involvement of the cornea with subsequent ulceration which may occur as a result of trauma.

A third point I want to emphasize is the necessity of employing a suggestion first made by Dr. Matas some years ago, at a meeting of the Southern Surgical Association; he laid stress on the fact that no attempt should be made to put alcohol into the Gasserian ganglion until it has been first anesthetized with some diffusible drug, and one that was least permanent in its effects. Dr. Allen stressed that point, and I simply want to emphasize it a little more.

My own conclusions are these: I am not quite sure whether in the future I will choose alcoholization of the Gasserian ganglion in preference to Frazier's operation. With the technic, as now advocated by Frazier, we have a more certain method by which a great many of these cases may be permanently benefited. The average operative relief from alcoholization has been less than one year, eight or nine months, when these

patients come back with recurrences. This has been impressed upon me by the work of Dr. Allen who has formulated rules and laws which can govern us in the second and third injections.

In the fourth place, in the debilitated cases, where a surgical operation is dangerous, we might try it. Here again I think it is an ideal method in malignant diseases of the upper jaw, and we have not that risk that we otherwise would have.

Dr. F. W. Parham, New Orleans, Louisiana.—I have not had much personal experience in this line of surgery. The three gentlemen who have spoken are par excellence experts in this line of work in New Orleans. There are two reflections I want to make after listening to these papers and which are called forth particularly from some experience I have had. One of these points has been emphasized both by Dr. Maes and by Dr. Matas, namely, that it is not a minor surgical procedure. If a surgeon were asked, if he could have another eye, and where he would like to have that eye placed, I think he would say he would like to have it placed on the index finger of the right hand, but, it seems to me, in doing this work it would be a tremendous thing if we could put that eye on the end of the needle because it is difficult to orientate one's self sufficiently to hit the foramen ovale. Dr. Allen, Dr. Maes and Dr. Matas by long experience have succeeded in doing this in such a way that it seems to the rest of us like magic the way they hit the foramen ovale; yet I have seen them miss it, showing that you cannot by any anatomical considerations absolutely render it certain to have hit the foramen. I have had several of these gentlemen fail to do it. Dr. Gessner has done a good deal of this work for me, but sometimes we fail to get in. I do not think any one has a right to do it until he has practiced sufficiently on the cadaver to do away with the difficulties that can be done away with by anatomical knowledge. The anatomical conformation of different skulls is such as to leave room for a mistake in an occasional case, although in the majority of cases the foramen may be reached by an expert.

The other point I want to speak of is this: Dr. Maes laid stress on the point that although the utmost care has been exercised, a serious effect on the eye has resulted. As he has said, it is a question in certain cases whether the Frazier opera-

tion would not be the better operation, because it is an open one; it is not a blind operation, such as the injection of the ganglion is. Yet the results in the hands of experts from the injection treatment have been so excellent, so flattering, that I do not believe that the time has come when we can think of discarding this form of surgery, but it should be confined to the hands of experts, and the ordinary man who has not practised on many cadavers has no right to do it.

Dr. Allen (closing the discussion).—One important point brought out in the discussion is the seriousness of the operation. I never take any of these cases for injection unless they are in a hospital as hospital patients, where they can be kept under observation and complete control. I never dismiss out of town patients where I have injected the ganglion without sewing up the eyelid, and without giving them rigid instructions to their doctors before they go home, and have them read those instructions carefully so that they understand them. It is decidedly better to have an ophthalmologist take care of the eye after injection, although this is not always necessary. I have known of such cases after injection where a pad was put over the lid and held down with adhesive plaster or a bandage, the doctor thinking it was too much of a procedure to dress the eye properly. That is dangerous. No pad should be kept in direct contact with the lid because the lids may open under the pad. The cornea is anesthetic and serious traumatic mischief may occur. With reference to the technic and orientation referred to by the previous speakers, that is an interesting subject to which I have given careful and close attention, and I would like to read from my paper, if I may have the time, selected paragraphs bearing on this subject. (Dr. Allen then read extracts from his paper which he had not time to finish during the time limit imposed.)

THE INTERPRETATION OF MUSCLE FUNCTION IN ITS RELATION TO INJURIES OF THE PERIPHERAL NERVES

By C. C. Coleman, M.D.
Richmond, Va.

The material for this discussion was collected in the neurosurgical service of General Hospital No. 11, Cape May, N. J., and No. 41, Staten Island, N. Y. A few observations made on private patients have been included to emphasize certain phases of the subject not supplied by the writer's data gathered in these reconstruction hospitals. All of the army patients had received wounds at least several months prior to coming under observation, and the large majority of them were studied for several months under conditions highly favorable to the investigation of the motor disability of peripheral nerve injuries. The cycle of disturbed function, ranging from great enfeeblement or total paralysis to complete return of muscle action, could often be noted during this period of observation. The degree of disability following injury of a peripheral nerve is estimated primarily in terms of voluntary movement, the sensory and trophic loss usually being of much less consequence than the motor impairment.

The determination of the exact amount and distribution of impairment of the function of the muscle groups assumes practical importance in the study of patients with peripheral nerve injuries. Recovery of voluntary movement is the most valuable evidence of regeneration of the paralyzed nerve from the standpoint of diagnosis and treatment. Accurate interpreta-

tion of voluntary movement requires careful and repeated examination of the affected muscles. A knowledge of the normal muscle action is often bewildered by the modification of an engrafted and persistent functional element. Associated lesions of the bones, joints, bloodvessels, muscle bellies and tendons frequently becloud the clinical picture. Much study is required in cases of combined injuries to classify the lesions accurately and assign to each its share of the responsibility for limitation or loss of voluntary movement. Analysis, on an anatomical basis, of muscle function as it is modified or abolished primarily by the nerve lesion is the purpose of the present paper.

The chief difficulty in the interpretation of muscle function in the distribution of an injured peripheral nerve arises from the unexpected appearance of voluntary motion in segments of the limb supplied by the nerve in question. Frequently the movement normally executed by the paralyzed muscle of the first order is accurately replaced by the action of subsidiary muscles supplied by a healthy nerve. The contributory action of these subsidiary muscles may appear only after paralysis of the muscles primarily responsible for the movement, and under such conditions the motor function of the normal neuromuscular mechanism may be closely imitated. Substitutionary muscle function, or the "supplementary motility" of Letievant, has been carefully studied in the peripheral nerve lesions of the late war. Practically all of the common substitutions were noted and most of them repeatedly observed in patients of this series. Months of intelligent effort on the part of the patient had developed the replacement of function by the substitutionary muscles to a confusing degree in many cases.

In the examination of voluntary movement Tinel's suggestion that the limb be placed in a position to abolish the opposing force of gravity is very pertinent; otherwise an extreme degree of weakness may easily pass for complete paralysis[2]. The larger number of substitutionary movements in patients with peripheral nerve injuries is found in the muscles of the upper extremity, and particularly in the intrinsic muscles of

the hand. Here the convergence of all the larger nerves of the arm, with the action of each sometimes reinforcing and again overlapping that of the others, may produce deceptive motor phenomena when one or more of the large nerves of the arm are injured.

The subject may be better presented if the components of function of the various segments of the upper extremity be studied consecutively from the shoulder to the hand. In my observation of paralysis about the shoulder girdle and upper arm substitutionary muscle function was not often noted. There was one patient, however, with complete paralysis of the deltoid, who was able to raise his arm above the level of the shoulder. This is an unusual substitutionary action brought about principally by the supraspinatus in conjunction with the trapezius and other fixation muscles of the shoulder. This case is of interest because of the common belief that substitution for the deltoid by the supraspinatus is ineffective and feeble.

Flexion of the Forearm. The mechanism for flexion of the segments of the upper extremity is well protected and exceedingly adequate. Flexion of the elbow is produced by the action of the musculocutaneous, median and musculospiral nerves. Flexion of the wrist may be effected by any one of the same nerves, while the movements of extension of these joints depend almost solely upon the musculospiral.

Paralysis of the musculocutaneous nerve abolishes the action of the biceps and usually the brachialis anticus, the muscles of the first order in the flexion of the forearm. Satisfactory flexion, however, can be produced by the solitary action of the brachioradialis supplied by the musculospiral, and flexion performed by this muscle is accurate and efficient (Fig. 1). The musculospiral supply of the brachialis anticus is a factor in flexion of the elbow in some cases. The pronator radii teres is also a flexor of the forearm, and one patient with paralysis of the musculocutaneous and musculospiral was able by practice to accomplish considerable flexion by developing the substitutionary pronator action (Fig. 2).

FIG. 1.—Paralysis of the left deltoid. Elevation of the arm by the supraspinatus assisted by the fixation muscles of the shoulder.

FIG. 2.—Atrophy of the brachialis anticus.

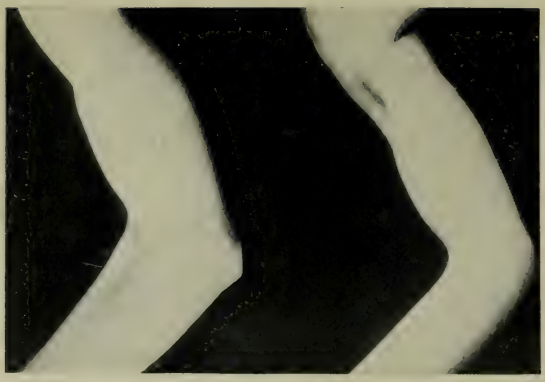

Fig. 2a.—Musculospiral paralysis of the right arm with paralysis of brachioradialis. Cut to left shows normal action of the brachioradialis in forcible flexion of forearm.

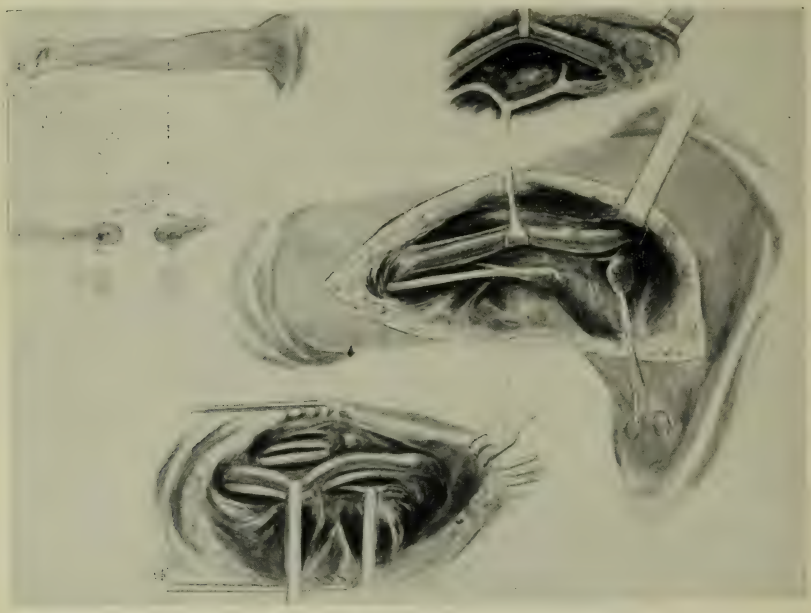

Fig. 3.—Division of right musculospiral nerve above branches to triceps. Complete loss of extension of forearm.

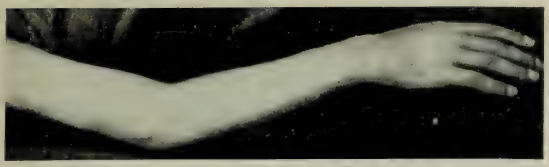

Fig. 4.—Flexion of the forearm by the pronator radii teres in patient with paralysis of the musculospiral and musculocutaneous.

Fig. 5.—Flexion of wrist against force of gravity by the extensor ossis metacarpi pollicis in complete paralysis of all muscles supplied by the median and ulnar nerves.

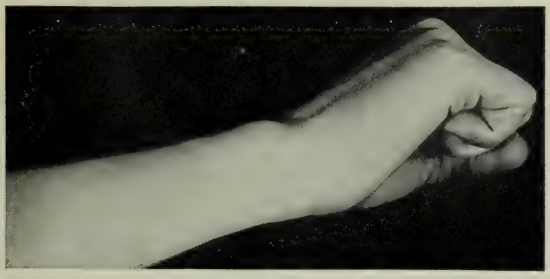

Fig. 6.—Extension of the wrist by forcible flexion of the fingers in musculospiral paralysis.

Fig. 6a.—Wrist-drop of musculospiral paralysis with slight hypotonia.

Fig. 7.—Musculospiral paralysis of fourteen years' duration. Patient has never worn a splint. Extreme hypotonia of extensor muscles of forearm. Forcible flexion of fingers produces no elevation of wrist.

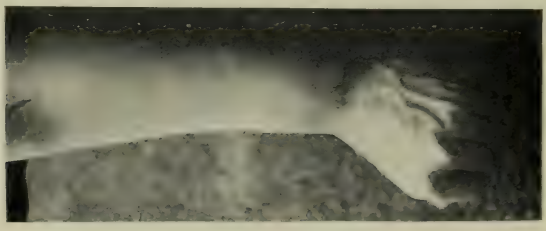

Fig. 8.—Extension of wrist by long radial extensor with deviation to the radial side. Paralysis of all other extensors of the wrist and fingers.

Fig. 9.—Abduction of thumb in ulnar paralysis.

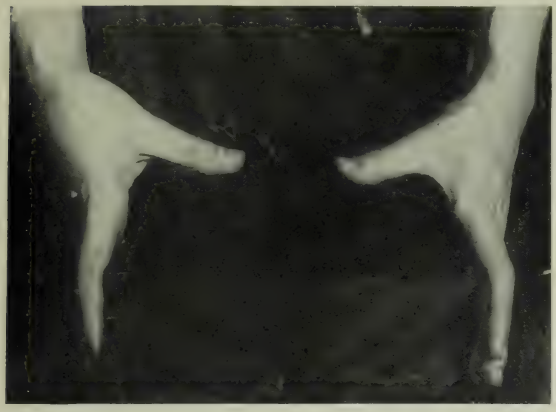

Fig. 10.—Abduction of thumb in right musculospiral paralysis.

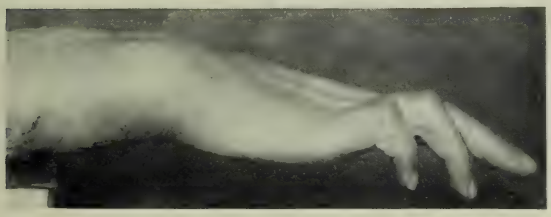

Fig. 11.—Characteristic griffe in low lesion of ulnar.

FIG. 12.—Ulnar paralysis. Note griffe atrophy of adductor of thumb and digital interossei.

FIG. 13.—Same patient as in Fig. 12, showing complete extension of distal phalanges when hyperextension of proximal phalanges is overcome.

Fig. 14.—Complete interruption of median and ulnar in upper arm. Flexion of fingers by extension of the wrist.

Fig. 15.—Complete paralysis of all median muscles, due to anatomical interruption of nerve in upper arm. By extending the wrist the patient is able to make considerable flexion of the index finger.

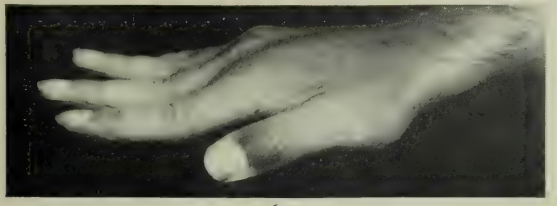

Fig. 16.—Musculospiral paralysis. The two distal phalanges can be raised from the table by the action of the interossei and lumbricales.

Fig. 17.—Appearance of hand in high median and ulnar paralysis. Flattening of the hand due to atrophy and unopposed pull of the extensors.

Fig. 18.—Spreading and complete extension of the fingers by long extensor simulating action of the interossei.

Fig. 19.—A favorable position for the detection of feeble voluntary movements of the leg and foot. The board should be well polished to permit freedom of movement while the force of gravity is abolished.

Extension of the Forearm. Extension of the forearm is accomplished entirely by the musculospiral nerve. Complete loss of extension of the forearm is infrequent in musculospiral paralysis, because the long head of the triceps receives its motor supply immediately after the nerve leaves the tendon of the teres major. Higher lesions of the musculospiral are very likely to involve either the brachial plexus or the other large nerve trunks of the axilla. One such case, with loss of forearm extension due to musculospiral paralysis, was operated upon. The lesion consisted of an anatomical interruption of the nerve just below the circumflex.

Pronation. Complete pronation of the forearm is effected by the pronator radii teres and quadratus supplied by the median. In paralysis of the median above the elbow no cases of substitution of normal pronator function were seen. The brachioradialis is capable of bringing the forearm to the neutral position; that is, midway between pronation and supination. Rotation of the radius internally beyond the neutral position was invariably the result of the action of the muscles normally responsible for the movement, and was not observed as a substitutionary movement.

Supination. Supination of the forearm with the elbow flexed is the result of the action of the biceps and supinator brevis. The brachioradialis is not a supinator of the forearm. It enters into this supination and can rotate the radius to the line of the neutral position, beyond which further supination is accomplished by the biceps and supinator brevis. With the forearm extended and external rotation of the upper arm by the muscles of the shoulder forcibly prevented the action of the biceps as a supinator is generally abolished, although this point is contested by Woods[6], who maintains that even with this precaution the biceps may cause supination.

Movements of the Wrist. Flexion of the wrist depends normally upon the action of three muscles, two of which are supplied by the median and one by the ulnar. Interference with the palmaris longus and carpi radialis (median supply) does not abolish flexion with deviation to the ulnar side by the

carpi ulnaris (ulnar supply). Anatomical interruption of both the median and ulnar nerves would suspend flexion of the wrist, but for considerable substitutionary flexion brought about by the extensor ossis metacarpi pollicis supplied by the musculospiral (Fig. 3). This substitution can be easily detected in median and ulnar lesions by passively moving the wrist to a position of hyperextension. Action of the extensor ossis with the hand hyperextended does not produce flexion of the wrist, but, on the contrary, assists in maintaining the extension. The extensors of the wrist are innervated by the musculospiral nerve acting principally through the extensor ulnaris and the short and long radial extensors. The communis digitorum and extensors of the thumb also participate in extension of the wrist. In musculospiral lesions above the elbow it has been frequently observed that the patient could elevate the hand by making forcible flexion of the fingers. This observation has been made by Benisty[1] and others, and was repeatedly verified in our experience (Fig. 4). The requirement for the dorsal elevation of the hand under such circumstances is a slight shortening of the extensor tendons. The movement cannot be accomplished, as pointed out by Pollock[3], if a considerable degree of hypotonia exists. The army splint in common use for complete musculospiral paralysis is no doubt largely responsible for the patient's ability to execute this movement, which is easily explained upon a simple mechanical principle as follows: The distance between the origin and insertion of the shortened extensors must be diminished to enable the patient to make forcible flexion of the fingers with muscles supplied by the healthy median and ulnar nerves. The distance necessary to enable the patient to make a fist is gained by the compensatory elevation of the hand. This explanation appears more logical than that offered by Hunt[4], based on the hypothetical projection through the peripheral nerves of differentiated tracts from the cortex and striate body.

Wrist adduction and abduction are the result of combined action of the extensors and flexors of the joint, although a certain amount of adduction is possible in paralysis of the

extensors through the action of the flexors ulnaris. This adduction, however, is incomplete and faulty and is accompanied by ulnar deviation. The extensor ulnaris acting alone is capable of effecting slight adduction without the assistance of the flexor ulnaris, whereas the radial extensors acting alone produce abduction with extension of the wrist.

Thumb Movements. Flexion and extension of the thumb are not effectively compensated when the primary muscles for these movements are paralyzed. A slight dorsal pull on the distal phalanx may occur as a substitution for the action of the paralyzed extensor longus pollicis when the opponens and flexor brevis pollicis carry the thumb across the palm. When this is done a shortened extensor of the paralyzed longus pollicis may act as a guy rope on the distal phalanx and produce extension. This movement is similar in mechanism to that causing elevation of the hand in musculospiral paralysis by making a fist.

Abduction of the thumb or approximation of the thumb to the radial side of the second metacarpal segment is produced primarily by the adductor pollicis (ulnar supply) and flexor brevis pollicis supplied by the median and ulnar. The opponens and extensor ossis metacarpi pollicis of the musculospiral group also assist in adduction of the thumb. Fixation of the thumb by the extensors is essential to every efficient action of the intrinsic thumb muscles. Movement of the thumb to a position perpendicular to the palm, or abduction, is effected chiefly by the abductor pollicis supplied by the median. The extensor ossis metacarpi pollicis and opponens also take part in abduction. This movement is a good test of median function and should not be confused with extension of the thumb. Approximation of the pulp of the thumb to that of the fingers depends upon the integrity of the median nerve acting through the opponens and adductor. The tip of the thumb may be contacted with the pulps of the fingers by the flexors of the thumb when the median is paralyzed, but the normally acting opponens supported by the abductor and extensors can appose the thumb and fingers at the level of the last articulations. Rota-

tion of the thumb is an opponens movement facilitated chiefly by the attachment of the opponens to the metacarpal bone and not to the phalanx of the thumb[5]. Rotation involves the action of all the muscles of the thenar eminence, the adductor and the long thumb extensors.

Movements of the Fingers. Complete flexion of the fingers is produced by the median and ulnar supply acting on the flexors sublimis and profundus digitorum assisted by the interossei and lumbricales. Our observations support the view that all the interossei, including the adductor of the thumb, are supplied by the ulnar. The action of these muscles in flexing the first phalanges and extending the second and third is reinforced by the lumbricales, the inner two of which are supplied by the ulnar and the outer by the median. Forcible flexion of the phalanges by the profundus acting alone, if continued, produces flexion of the second and finally the first phalanges. Atrophy of the interossei results from ulnar paralysis and is not evident in the case of injury to the median alone. The characteristic ulnar griffe (Fig. 5) is more pronounced in low lesions of the ulnar and the mechanism of its production results from the unopposed hyperextension by the common extensors (Fig. 6) of the first phalanges of the ring and little fingers. The two distal phalanges are partly flexed by the pull of the sublimis and profundus digitorum. The action of these long flexors of the fingers in ulnar lesions is unopposed in the second and third phalanges of the fingers by paralysis of the interossei and inner two lumbricales which normally extend these phalanges. The index and middle fingers are not affected in ulnar griffe because of the median supply acting through the lumbricales, which are feeble antagonists of the common extensor action. By supporting the first phalanges of the ring and little fingers of a patient with ulnar griffe, complete extension of the fingers may take place In combined median and ulnar lesions the patient is able to produce moderate flexion of the fingers by extension of the wrist. The flexion movement of the fingers, thus performed, is produced by the increase of distance between the fixed points

of origin and insertion of the inelastic long flexors in the act of extension of the wrist. As the wrist is elevated in extension the fingers are pulled down to a point within the length of the flexors, which have been made to assume a curve by the extension of the wrist. Although the flexor profundus is partially paralyzed in high median lesions the patient is generally able to flex the three inner fingers forcibly, due to the fact that the profundus slip to the middle finger is supplied by the ulnar nerve. The principal disability of a median injury, so far as finger movements are concerned, is inability to flex the first finger, and even this movement of the index may be effected in some cases by extension of the wrist (Fig. 7).

Extension of the Fingers. In musculospiral paralysis the patient is unable to extend the first phalanges. By supporting the primary phalanges, however, extension of the two distal segments of the fingers is easily accomplished by the interossei and lumbricales. Extension of the two terminal phalanges of the fingers is not always abolished by paralysis of the interossei and lumbricales. In many cases of ulnar paralysis the common extensors are capable of making complete extension of all the segments. Although the musculospiral nerve does not supply any of the intrinsic hand muscles, the function of all of these muscles is seriously impaired by paralysis of that nerve. By its action through the extensors the stability of points of leverage of these intrinsic muscles is made effective.

Lateral Movements of the Fingers. Lateral movements of the fingers are effected chiefly by the interossei, but substitution for both adduction and abduction of the fingers is found frequently in the action of the long flexors and common extensors of the fingers. The common extensors are capable of spreading the fingers in accurate imitation of the action of the interossei, while the contraction of the long flexors causes adduction of the fingers. Great care is necessary in determining interossei action in the movements of adduction and abduction of the fingers. The fingers should be flexed at the metacarpophalangeal joints to eliminate the action of the long

extensors. There is no sign by which ulnar paralysis can be positively determined by examination of the voluntary movements of the fingers. The ability to superimpose the extended little finger upon the palm of the ring finger is a simple and practical test of ulnar function in the large majority of cases. In some injuries of the ulnar nerve the amount of disability is so slight that an estimate on an anatomical basis exaggerates the importance of the lesion. The refinements of finger motility are usually impaired by ulnar lesions.

Lower Extremities. Interpretation of muscle function of the lower extremity is much simpler than that of the upper, chiefly because of the minor importance of the intrinsic foot muscles as compared with those of the hand. Attention has been directed principally to the disturbance of the coarser muscles in the investigation of voluntary movement of the lower extremities. Substitutions of movement are not frequent. Flexion of the leg and thigh is rarely abolished in sciatic paralysis, because of the preservation of function of the semitendinosus. This branch leaves the trunk at a high level and usually escapes injury. No case of sciatic paralysis operated upon by me showed inability to flex the knee because of the nerve lesion.

Extension of the leg was rarely a matter of investigation in the series because of infrequency of anterior crural paralysis. One such case, now under observation, shows substitution for the quadriceps action by the tensor fasciæ femoris supplied by the superior gluteal. Walking is characterized by hyperextension of the knee maintained in this position by the tensor faciæ femoris, and the usual secondary hydrarthrosis is present. Supplementary movements of the ankle-joint are fairly frequent when the muscles of the first order are paralyzed. Inversion of the foot effected by the tibialis anticus supplied by the external popliteal may be simulated by the tibialis posticus unless the foot is held at right angles. Substitution for the loss of dorsiflexion of the foot was not observed. Plantar flexion normally accomplished by the calf muscles may be produced by the action of the peroneus longus.

Toe movements are sometimes confusing when the contraction of the antagonists of the paralyzed muscles is followed by a rebound simulating the normal action of the muscles under investigation. If the dorsiflexors of the toes are paralyzed and the patient attempts to contract the paralyzed muscles, plantar flexion of the toes may be the initial movement followed by a rebound of the toes to the original position. The rebound resembles slight dorsiflexion and may be deceptive. The movement desired should take place from the position of rest without a preliminary motion of the antagonist. Errors may be avoided by analysis of the components of the movement.

References

1. Athanassio-Benisty: Clinical Forms of Nerve Lesions and the Treatment and Repair of Nerve Lesions, Military Medical Manual, London, 1918. Quoted by Pollock.

2. Tinel, J.: Nerve Wounds.

3. Pollock: Supplementary Movements in Peripheral Nerve Lesions, Archives of Neurology and Psychiatry, November, 1919.

4. Hunt, J. Ramsay: The Existence of Two Distinct Physiological Systems for the Transmission of Motor Impulses in Peripheral Nerves, Brain, November, 1918.

5. Silbert, S.: The Action of the Intrinsic Muscles of Hand, Neurosurgical Exchange, U. S. G. H., No. 11, Cape May, N. J., 1919.

6. Woods: Misleading Motor Symptoms in the Diagnosis of Nerve Wounds, Archives of Neurology and Psychiatry, November, 1919.

SPERMATOCELES AND HYDROCELES CONTAINING SPERMATOZOA

By Randolph Winslow, M.D.
Baltimore, Md.

Among the not very frequent pathological conditions of the testicle is spermatocele. A spermatocele is a cystic tumor containing spermatozoa, which usually arises from about the junction of the testicle and the epididymis, and is situated behind the tunica vaginalis. A spermatocele is generally a rather small inverted pear-shaped cystic mass, extending upward along the spermatic cord. It is not painful, and, as a rule, does not cause any discomfort or annoyance, except by its presence. Sometimes it protrudes into the tunica vaginalis and then it takes on the characteristics of a hydrocele. It occurs, usually, between 20 and 40 years of age, but is sometimes found in old men. It is found more frequently on the right than on the left side, and it may be bilateral. It has been supposed that the condition was due to degenerative changes in fetal remains about the testicle and epididymis, such as the organ of Giraldès; the hydatid of Morgagni; the vas aberrans and the vas du rete. But A. C. Cabot says this is an error, and that a spermatocele is a true retention cyst and is due to any process which blocks the outlet of seminiferous tubules. The larger cysts in the young are due to obstruction of the vasa efferentia, while the small cysts of later life are due to senile cystic enlargements of the tubules. The cyst may be extravaginal or intravaginal. It is said to be extravaginal when the cyst develops in a direction in which there is no covering of

tunica vaginalis; and this is the most common variety; and intravaginal when it arises from some portion of the testicle or epididymis which is covered by tunica vaginalis. The diagnosis is made by aspiration or incision, but the nature of the cyst may be suspected from its location between the testicle and the epididymis. When the tumor has projected into the tunica vaginalis, or is complicated with a hydrocele, the differentiation will be difficult and is unimportant.

Hydroceles Containing Spermatozoa. The occurrence of six cases of hydroceles containing spermatozoa, and of one of true spermatocele associated with a hydrocele, at the University Hospital, Baltimore, in the course of a few months, has directed my attention to this condition and has aroused my interest in it. How do the spermatozoa get into hydroceles? Is the hydrocele due to the presence of the spermatozoa, or does the hydrocele by pressure cause a communication between the seminiferous tubules and the cavity of the tunica vaginalis? I do not know of any observations that will answer these questions. It is conceivable that a trauma of the testicle could rupture tubules and permit the escape of sperm cells into the tunica vaginalis. In the cases of which I have notes no mention is made of an injury, except in one instance, that of a man, aged fifty-five years, who was struck on the scrotum when he was a boy. He had had a hydrocele for forty years, but there is no way of determining how long the spermatozoa had been present in the sac.

I think it probable that in some cases, at least, true spermatoceles rupture into hydroceles, and in that manner permit the ingress of spermatozoa into the sac of the tunica vaginalis. In one case there was a hydrocele with clear contents, and contiguous to but not communicating with it was another cyst containing a milky looking fluid, which showed spermatozoa when examined with the microscope. It is quite possible that this cyst might have ruptured into the hydrocele, if it had remained longer unoperated.

In another case, in which 200 c.c. of a slightly milky looking fluid was evacuated, which contained spermatozoa, several

small cysts connected with the epididymis were observed, which contained a fluid similar to that in the tunica vaginalis. I think it is probable that one of these small cysts had ruptured into the hydrocele.

In another case there were two sacs which communicated, one being the tunica vaginalis and the other extending up to near the external abdominal ring. This second sac may have been a true spermatocele. While the presence of spermatozoa in hydroceles is interesting, I do not know that any special significance is to be attached to this condition. The external appearance of the cyst does not differ from that of ordinary hydroceles, and the presence of the spermatozoa is only suspected when a whitish fluid is withdrawn. Possibly by transillumination light would not show as clearly as when the sac contained straw-colored fluid. In the cases that have come to my knowledge all were operated on under a diagnosis of hydrocele. Not always, however, is the presence of a whitish fluid in the tunica vaginalis due to spermatozoa; in some a chylocele forms and the milky color of the fluid is due to oil globules. A microscopic examination in such a case would show oil globules and possibly filariæ as well. A remarkable case of a hydrocele containing spermatozoa was that of M. S., aged eighty-three years, who had a very large hydrocele on the right side, which had been present for thirty years. This was tapped and 900 c.c. of a whitish fluid was withdrawn. This fluid contained numerous actively motile spermatozoa. The patient's age and physical condition did not justify any radical procedure, and the case is noteworthy on account of the large size of the cyst, the numerous motile spermatozoa in the fluid and the advanced age of the man.

The treatment of true spermatocele is usually excision; while that of the hydrocele containing spermatozoa is similar to that of ordinary hydroceles, namely, excision of the tunica vaginalis, or suturing the tunica behind the testicle, or Andrews' bottle operation, etc., and the results appear to be equally as good as those of uncomplicated hydroceles.

My interest in these cases, however, is chiefly in the answer to the query, "How do the spermatozoa get into the hydroceles?"

DISCUSSION

Dr. J. Wesley Bovée, Washington, D. C.—I think there have been numerous investigations which will answer this question for Dr. Winslow. It is claimed by many observers that spermatozoa may be found in various parts of the body, having permeated the tissues.

PAINLESS HYPODERMOCLYSIS

By Willard Bartlett, M.D.
St. Louis, Mo.

The vicarious administration of water has been revolutionized in my service by the employment of local anesthesia from the beginning to the end of the procedure. It seems remarkable, in view of the perfection of local anesthesia technic everywhere in minor surgery, that we have been content with a hypodermoclysis which in most instances must have seemed to the patient little short of brutal.

Sporadic attempts have been made to minimize the discomfort attending some of the steps in the operation, but I submit herewith a technic which has on many occasions worked so well that the patient has not at any time paid the slightest attention to the introduction of comparatively large amounts of water. I will grant that nothing is claimed in the rare instances in which nervous patients, objecting to local anesthesia in any form, have forcibly opposed its use.

A very extensive employment of infiltration anesthesia led to the suggestion of introducing very dilute novocain when we had been in the habit of using straight salt solution or, what may be better, distilled water. This came about quite naturally after using in a very few anesthesias abnormally large quantities of ½ per cent. novocain solution, and reflecting that the introduction of a few 100 c.c of fluid into a partially dehydrated patient had to some extent offset the possible risk of employing what may well be considered a toxic dose of the novocain which seemed indispensable to the performance of a much-needed surgical operation.

I will state in passing that I have never observed dangerous toxic symptoms following the employment of novocain, although I have frequently far exceeded what is commonly given as the maximum dose. In the evolution of this method we gave as hypodermoclysis gradually increasing amounts of fluids, in which from time to time the percentage of novocain was cut down first from ½ to ¼, then to ⅛, and finally to 1/16 of 1 per cent., without the anesthetic value of the drug being appreciably diminished. I am perfectly well aware that so distinguished an authority as Braun writes that he has never been able to use novocain successfully in a concentration as low as ¼ of 1 per cent. This has not, however, been in accordance with my own experience or that of Allen, Farr, Wennerman and others, who are making very extensive use of this substance. Now I do not wish to be understood as advocating ⅛ or 1/16 per cent. novocain solution in the performance of surgical operations, but this I can state conclusively that 1/16 suffices for the introduction of fluid under the skin.

It was but a further step in the technic to add sterile morphin to the hypodermoclysis fluid. Many a patient requires this drug for the same manifestations which indicate hypodermoclysis, and surely the morphin effect is an aid in combating any possible discomfort attending the introduction of fluid under the skin. The dosage is, of course, to be determined by the rapidity of inflow, age and condition of the patient, and all the other elements which ordinarily enter into the employment of this, to the surgeon, valued drug. When hypodermoclysis is used in any of the conditions such as shock, hemorrhage, etc., which are attended by a fall of blood-pressure, we are accustomed to add adrenalin to the fluid. A constant inflow of this substance is highly desired, since its destruction is so rapid as to make the effect of every small dose of short duration.

The use of freshly distilled water instead of salt solution in my service commenced in 1915, at the suggestion of my then house surgeon, Dr. O. F. McKittrick. It occurred to him that the introduction of sodium chloride solution in large

amounts led to an undesirable salt concentration in the body. He experimented in every way, after discussing with Dr. Erlanger, any possible risk of employing water, and obtained most gratifying results. By comparing water and salt solution introduced at the same time in the two axillæ of the same individual he found that water was absorbed more rapidly than the other fluid. He used as high as 10,000 c.c. in three days, and in only a few instances noted an accident which might have happened if salt solution had been used, namely, an extensive imbibition of the subcutaneous tissues took place in jaundiced individuals.

The choice of a method of vicariously administering fluid becomes a matter of even greater importance, perhaps, than was formerly supposed to one who reads the astonishing results obtained by Balcar, Sansun and Woodyatt in their article entitled "Fever and the Water Reserve of the Body," which appears in the *Archives of Internal Medicine,* July, 1919. As they suggest, no doubt salts do hold water in association with themselves, which may be an argument for the administering of sterile water instead of salt solution under the skin. However this may be, I am not at all sure that sterile water, which is not an isotonic material, can always be used without undesirable local effects. On many occasions, as above noted, it has served me well, but at other times its use has been followed by tissue changes, which, however, it is only fair to state in comparison one occasionally sees when salt solution is employed. In this connection I am glad to be able to quote verbatim a communication received recently from Dr. Evarts A. Graham: "For some time I have been using glucose solutions hypodermically in concentration of from 2 to 5 per cent. A solution of about 3 per cent is nearly isotonic with the blood, and, as a matter of fact, it is possible to exceed this amount considerably without damage, because of the rapid disappearance of the glucose in the tissue. Glucose solutions hypodermically have a decided advantage over ordinary saline solutions, because, in the first place, glucose is, of course, a food which is readily utilized by the body; in the second place,

glucose is a very efficient antiketogenic substance, so that it is of great value in combating any existing acidosis which is usually present to some degree in conditions which require the injection of fluids, such as postoperative conditions of all kinds, infections, inanition, etc.; in the third place such a solution has the decided advantage of liberating 'free' water gradually to the tissues as the glucose is burned by the body."

The apparatus we use is simplicity itself, consisting of the ordinary 700 c.c. glass drip bottle, a rubber tube one yard in length, controlled by a screw clamp, and a slender, long needle, No. 18 of 1/32-inch bore. This is substantially the apparatus commonly used by hospitals for the introduction of water into the rectum, with the exception that we have, for ordinary use cut out the drop sight feed attachment, since we make use of a local anesthesia agent, and naturally the rate of inflow into desensitized tissues does not matter particularly. The inflow is regulated according to the rate of absorption, the water-logged area never being allowed to become unreasonably tight, and thus threaten tissue pressure necrosis. The needle sometimes has to be withdrawn, cleaned out with a wire and reinserted if it becomes plugged.

We find the flank midway between the lower ribs and the prominent upper curve of the ileum to be the site of election, since less subsequent damage has occurred here than elsewhere. We no longer inject fluid under the breast of a woman, because she is likely to experience a great deal of pain every time she takes a breath for some hours after the anesthesia effect of the fluid has worn off. The same thing is true with movement of the upper arm if a fluid has been injected about the axillæ or the pectoral muscles. Furthermore, the cavity of the axilla contains structures which are by no means indifferent to a long needle, wielded by an inexperienced nurse or a careless intern. If worst comes to worst, and the avoidable as well as inexcusable accidental infection occurs, this is distinctly more to be dreaded in either of the three regions enumerated than it is under the skin of the flank, where surgical treatment is a comparatively simple matter.

The introduction of the needle is made painless by an ethyl chloride spray on the skin. After the needle has been introduced the region is covered by a small square of gauze, held in place with adhesive, and the surgical aspect of the little procedure is complete. Then it remains only for a nurse, or the patient himself, if he be a very reasonable individual, to control the rate of inflow.

In some few instances the ordinary sight drip apparatus has been employed and 40 to 80 drops admitted per minute; but any form of graduated clamp may be used and opened or closed at will. It may be noted in passing that plethora is a possibility here, and a patient who is receiving large amounts of fluid should be examined occasionally for evidences of cardiac dilitation or pulmonary edema.

Our three vital bodily needs are oxygen, with which we cannot dispense for more than a few minutes; water, which we can go without for a few hours, and food for which an urgent need becomes apparent after a few days. These three essentials to a vegetative existence are of such paramount importance that a little more detailed discussion of water in its relation to the human organism cannot fail to be of interest. An intake and output record must be kept wherever there is any difficulty about the ingestion of fluid or any great alteration in its output. This goes without saying in the routine of a well-regulated hospital.

Thirst is not altogether a matter of the amount of fluid in the tissues, hence one must not promise too much for hypodermoclysis as an immediate reliever of this aggravating manifestation. There is only one way to relieve thirst, as such, but a reasonable individual will try hard to bear this form of torture if he be assured that his tissues are really getting plenty of fluid, although none is swallowed. There is, of course, a great variety of reasons why fluid cannot be taken in the normal manner. An individual who is vomiting usually does better if his stomach is given a rest, no matter what the cause may be. There can be no argument regarding the advisability of keeping fluids away from one suffering from mechanical

obstruction of the digestive apparatus. It is in many instances better to keep the gastro-enteric tract at rest for a time after it has been the subject of surgical or other forms of trauma, and surely no fluid may be swallowed if the spread of a peritoneal infection is to be limited by intestinal quiet.

There are, indeed, many avenues for the introduction of fluid into the human body. The intravenous administration has, of course, a place in our therapeutics, and in many cases has been used with great success for drop by drop saline. This requires, however, a certain degree of surgical skill, and is perhaps not generally applicable. The gall-bladder has been employed with great success by McArthur, Matas and others, but is available in only a small percentage of individuals who have to have fluid. The intraperitoneal method is used largely by pediatricians, but seems not to have been generally employed in adults. Fluids have been introduced into arteries, but I believe this phase of the subject can be dismissed without any discussion. Some fluid is absorbed from the pleura, but no one would think of utilizing that membrane for the introduction of water under ordinary circumstances. It is not at all difficult to introduce a small cannula into the intestine during an abdominal operation; still, the intestine is not always available, and the risk of sepsis would probably offset to a certain extent any value attached to the method.

Proctoclysis is widely used, and was, up to about two years ago, supposed by me to be a procedure of considerable usefulness, although disturbing to my patients. I gave it up because painstaking nurses finally convinced me that the fluid was not usually retained, and I would take the liberty of suggesting that those who think it of value administer it a few times in person and watch the results before continuing to use it as a routine procedure.

Hypodermoclysis has given me greater satisfaction than has any other method of introducing fluids vicariously; yet it is not ideal, nor is any other procedure but drinking. When one orders hypodermoclysis he does so with the full knowledge that infection or tissue devitalization is possible and that the region

affected is quite likely to remain very tender for two or three days; but of one thing he may now be reasonably certain, namely, that a continuous inflow of 1/16 per cent. novocain can be maintained with most patients, as long as indicated, without causing discomfort or toxic symptoms.

DISCUSSION

Dr. J. Shelton Horsley, Richmond, Virginia.—Dr. Bartlett has called attention to an important complication that may happen after any serious operation—dehydration of tissues—and one I think that occurs more frequently than we will admit, unless we have looked into the subject very carefully, as Dr. Bartlett has done. One point I desire to call attention to is that Dr. Bartlett spoke of the necessity of giving water, but at the same time you can administer other things that will add greatly to the comfort and to the vitality of the patient. For instance, you can approximate the blood serum by giving Locke's solution. Glucose is important from the standpoint of nutrition, and in the Locke solution you have glucose with calcium salts which are important for the heart mechanism and sodium salts. These will be absorbed ordinarily as rapidly as salt solution, so that the patient gets not only the benefit of the water but the salts plus glucose. In many of these cases hypodermoclysis is essential where there is suppuration. Many of them may have peritonitis. There is a danger in connection with hypodermoclysis that a hematogenous infection may occur where you create trauma by the injection. That is a minor consideration when the patient's life is at stake. I use hypodermoclysis now more freely than ever, using the Locke solution entirely. As to the location, we find that pointing the needle up toward the axilla, and not under the mammary gland, especially in the male, is a satisfactory method. The solution is absorbed rapidly, for it infiltrates the tissues around the axillary lymphatics and seems to be taken in quite abundantly.

Dr. R. S. Hill, Montgomery, Alabama.—I wish to endorse what Dr. Bartlett has said. His experience corresponds abso-

lutely with that of Dr. L. L. Hill and myself. The use of salt solution by rectum has not been satisfactory in our hands. In spite of everything we could do a large part, if not practically all, of the solution would find its way in the bed, particularly after the first few administrations. For some time we have been relying on the hypodermoclysis. In the class of cases referred to by Dr. Horsley—suppurative cases—we give two to three pints of salt solution by hypodermoclysis twice daily. We believe there is nothing that equals this treatment in these cases. We begin it as soon as the operation is commenced and continue it until the patient has weathered the storm and is on his way to recovery.

Dr. J. Wesley Bovée, Washington, D. C.—This discussion I think is a very useful one, and there are some elements left out of it which may be considered. One particularly is the matter of the solution used. I believe a great deal of the complaint from failure of patients to retain the solution by proctoclysis is due to the temperature of the solution being too low. About twenty years ago I devised a thermometer to introduce into the current near the intake of the body, which would give the temperature there, and I noticed often that the proctoclysis temperature would be 15° or 20° lower than what it was in the reservoir. I remember distinctly what Dr. Hanks of the Woman's Hospital, New York, in discussing hypodermoclysis before the American Gynecological Society said, in extolling hypodermoclysis, that the patients would occasionally have a chill, but this was easily remedied by a hypodermic of morphin. I think we do these patients great harm by introducing into the tissues under the skin or in the rectum these cold solutions. In proctoclysis I find great satisfaction in the administration of it by elevating the foot of the bed twelve to sixteen inches, and in giving the proctoclysis solution I am governed by the thermometer as mentioned, the temperature being as near 105° as we can make it at the intake, and the solution going in about 30 or 40 drops a minute. I have had success by that method of proctoclysis which is opposite to what Dr. Bartlett has done.

Dr. Hugh H. Trout, Roanoke, Virginia.—Dr. Bartlett has contributed a great deal to the subject of postoperative treatment, when he calls attention to hypodermoclysis to be employed

in those cases in which absorption by proctoclysis is too slow, or for some reason the rectum cannot be used; but if he intends to do away with the use of water by rectum, I am sure he is mistaken. We have used water by rectum in something over 6000 cases; in fact, we now use it in all our cases, and very seldom have any trouble with it. We started using it instead of normal salt solution for relief of thirst in our postoperative cases.

As regards leakage of the solution, or water, there are a great many factors entering into the question of whether there is leakage around the tube in the rectum or not. The biggest factor is to see the rectum has been emptied by an enema and, if this is the case, I do not believe you will have leakage, or discomfort, except in very few cases. In over 2000 cases we have used glucose in various combinations, by rectum, and glucose, as you know, stains the linen yellow, giving us a very accurate test to see whether there is any leakage or not. I am not prepared to say in what percentage of cases the glucose solution leaked, but it was an extremely small one. There are many drugs one can combine with plain tap water when given by rectum, and I doubt if some of these would be well tolerated under the skin.

We have had a slough of skin following a subcutaneous injection of sodium bicarbonate and glucose, and I, therefore, feel one would have to be very careful regarding the drugs combined with water if given hypodermically. In addition to this, the solution to be given under the skin would have to be sterile with all the trouble incident thereto. In passing, it has been found by some men, sterile water is not absorbed from the rectum as readily as plain tap water. Our own work shows, as some of you may recall, the average amount of water absorbed by rectum per day was 500 c.c. more than in a similar series of normal salt solution cases. I feel quite certain Dr. Bartlett does not mean for us to abandon proctoclysis, but intends to call our attention to the further application of hypodermoclysis, with which I thoroughly agree.

Dr. Rudolph Matas, New Orleans, Louisiana.—Dr. Bartlett has presented a timely topic for discussion—one that interests every practical surgeon who appreciates and welcomes all help he can get in tiding his patients over the anxious crises that follow in the wake of the graver operations.

We are all familiar with hypodermoclysis and its value in supplying fluids in the course of and after operations upon exhausted, shocked, and dehydrated patients. No one questions the excellence of the technic advocated by Dr. Bartlett or the value of this measure as indicated by him; but there are some questions related to this procedure which deserve our attention. In the first place, is sodium chloride in isotonic or physiological solution the best agent for continuous administration? We have learned that saturating (and often supersaturating) the organism with salt water is a mistake. There is no question in my mind, at least, that glucose is of much greater value as a postoperative restorative agent. In proper solution it is superior to salt water in its nutritive quality, it is superior as a cardiac stimulant, as proved by physiological and clinical experience, and it is superior as an eliminant through its powerful diuretic action. I need not dwell upon other objections to the unlimited administration of salt solutions, especially when the efficiency of the renal functions is seriously impaired and compromised by septic and toxic processes. Therefore, I have for years dispensed with salt solutions except in emergencies and especially in acute hemorrhages, in which the prime indication is to supply a sufficient quantity of an artificial serum to restore the failing blood-pressure. Furthermore a properly prepared glucose solution is not always available in emergencies and, under the circumstances, a physiological salt solution which is immediately available will always remain a precious life saving agent. But whenever glucose is available, I prefer it as a basis for the infusions whether these be given by the subcutaneous, rectal, or the intravenous route. But it is not only to the salt itself that I would object as a routine solution. It is to the fallacies that underlie the administration of any form of artificial serum or fluid by either the subcutaneous route or natural avenues that I would call attention. There are many cases in which proctoclysis is not well tolerated or is not serviceable because of the failure of the bowel to retain or to absorb the fluid, and this is practically true of all cases in which the portal circulation is obstructed in the liver or elsewhere. We cannot then count upon this usually available avenue to supply the urgent needs of the circulation. In many cases the oral route, which is the most physiological, is barred by an irritable stomach

which rejects all that is put into it. And this is most unfortunate, because we have learned by long experience that no artificial serum or plasma, no matter how cunningly prepared to imitate the fluids of the blood, can compare in efficiency or restorative qualities to the plain water ingested by the natural route and prepared for admission into the circulation by the alimentary tract itself. We know, as a fact, that the prognosis is always better when the patient can drink and retain water freely and copiously after hemorrhagic and shocked septic states. We knew this long before, but the experiences of the war has clearly emphasized and demonstrated this fact. But we now have in mind the acute traumatic and postoperative states in which the normal routes are barred to us. Some quick way of reaching the circulation directly to relieve the water famine and restore the blood tension must be devised as an immediate necessity. It is then that hypodermoclysis fails and cannot be depended upon. The fluids injected under the skin are not absorbed, they remain stagnant wherever they are placed. The peripheral circulation is too feeble to take them up in time to save the heart and the vasomotor centers and to replace the lost volume of blood. It is then that intravenous infusion becomes the chief, if not the sole, avenue of salvation. If the patient reacts and responds to an intravenous infusion, whether it be a physiological salt or glucose solution, the subcutaneous infusion will then become available for continuing the supply of fluids, and in this way it is a precious resource. But the effect of intravenous infusions, no matter how brilliant they may be at the moment, often soon pass away with a relapse into the same feeble, stagnant state of the capillary and peripheral circulation. Absorption of the fluids ingested into the subcutaneous tissues by hypodermoclysis fails and the critical stage is again reached when other means must be resorted to to stimulate the failing heart and the vasomotor centers. Usually the same intravenous infusion is repeated with or without adrenalin, but often the effects are transitory and the small flickering flame of life is finally extinguished. This is particularly true of the shocked and septic cases. The experiences of the war has brought to light the great differences between artificial sera and the plasma solutions. The advantages of a fluid of greater density that approaches the normal viscosity of the blood are apparent.

Viscous fluids will be held longer in the circulation than the plain artificial sera, which quickly escape out of the capillary filter and drain into the tissues. Hence the promise of better and more lasting results from the Bayliss gum-salt solution and the Hogan gelatin solution which found frequent application during the war (especially the former), as substitutes for blood transfusion when the blood was not available. But the Bayliss solution requires a most careful, exact, and time-consuming technic for its proper preparation, and, while it has undoubtedly a large field of usefulness, it is not available in many of the emergencies that we have under consideration. It is, again, under these circumstances that I have found the continuous instillation of an artificial serum, preferably warm glucose solution by the intravenous route, most advantageous. This method which may be labeled the "intravenous drip" is easily applied by leaving the cannula in the vein, after the preliminary infusion has been made. With the cannula *in situ*, the artificial serum is allowed to drip into the vein precisely in the way that the Murphy rectal drip is regulated to keep up a continuous proctoclysis. The flow into the vein can be regulated to a nicety. If the pulse shows signs of failure, the flow is increased and the effect upon the pulse and the blood-pressure is noted. As long as the pulse is fair and the blood-pressure is above the critical point (60 diastolic) the drip is kept up very slowly at the rate of 40 or 60 drops per minute.

I am satisfied, by my experience in the last four years, that in certain critical cases in which the peripheral circulation is too feeble to absorb the fluid injected by hypodermoclysis, and when the normal routes of the alimentary canal are not available, this method will prove a supreme resource in tiding over a great crisis. I have not had sufficient experience with the Bayliss gum-salt solution, to pass judgment upon its merits, but from the limited experience I have had with it, I feel that it has a useful future before it. In the class of cases that we are considering, it could be used intermittently or alternately with the glucose (5 per cent.) solution by the intravenous drip method which I have described. In applying the continuous "intravenous drip" the importance of maintaining a proper temperature and regulating the dosage according to the condition of the circulation cannot be exaggerated. Cold solutions are

injurious to the myocardium; they depress the bulbar center and increase shock. Whenever medication is indicated, with pressor drugs and cardiovascular stimulants, it is obvious that this method will ensure the greatest accuracy and certainty of administration.

Dr. Willard Bartlett (closing the discussion).—I have nothing to say except I believe if men will personally witness one or two or more introductions of fluid into the rectum after operation they will become converts to hypodermoclysis.

SHOES

By Robert Carothers, M.D.
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The purpose of this paper is a discussion of three points, namely, that the very great majority of adult Americans have some defect or acquired deformity of their feet; that abnormal feet are responsible for many of the other defects in their anatomy, and that, in many and most instances, the foot deformity is caused by ill-shaped and incorrectly designed shoes.

An examination of the feet of several hundred little children will show normal feet, excluding congenital defects and those caused by disease, such as paralysis. The examination of the feet of several hundred adults will show deformed feet.

In making a practice to examine the feet of all patients regardless of their other complaints, seldom, almost never, does one find an absolutely normal foot, and a safer bet is this statement if they are women. We all start with good feet, while the majority of us acquire bad feet. The surgeons who worked on the draft boards, examining young men for the army, were surprised to find so many young men who had bad feet. A very large percentage of the rejections and those consigned to the limited service were thus classed on account of defective feet, so say the records.

When the opportunity presents, and to one especially interested, many pleasing and profitable hours can be spent studying feet. Sitting on the benches on the Boardwalk at Atlantic City affords a wonderful opportunity to see walk by in a few hours many thousand pairs of shod feet; and while the effect

produced in foot-bearing—stride, carriage of the body and sometimes even in the expression of the face—is to be assigned to this or that particular kind of shoeing, what is even more interesting is to see those same feet unshod and their owners practically or almost unclothed on the beach and observe the many deformities those feet show and the effect upon the body above they produce, such as bucked knees, flat lumbosacral backs, pot-bellies and round shoulders.

The foot is really a tripod. The heel, or os calcis, the base of the big toe, or distal end of the first metatarsal, and the distal end of the fifth metatarsal constitute the three points of the tripod. The longitudinal, anterior and outer arches form the spaces between the points of the tripod. The most essential thing for strength and a good functionating foot is to have the tripod placed correctly, so that the weight-bearing would be equal on each of the three points of the tripod. This is best illustrated by the normal bare feet about six inches apart and the inner borders parallel to each other. If one will draw two parallel lines forward, commencing at the extreme end of the heels, these lines will come through about the fourth toe, showing that the greater part of the anterior foot is on the inner side of that line.

It would seem, then, that a good shoe would be one which conformed to the normal foot and in no way prevented the foot from remaining normal. Such a shoe would grasp the back part of the foot firmly and snugly but not too tightly, it would have a low, broad and flat heel; the shank is reasonably long, and, although a support is unnecessary, it is not objectionable. The front part of the shoe will swing inward (after the crooked last), be broad and allow the front part of the foot and toes free motion, not unlike a hand in a bag. In looking at the bottom of a shoe, take a point at the extreme tip of the heel and draw a line bisecting the straight border of the heel at a right angle at its center, and, continuing this line, it should cross the front part of the shoe in such a way that at least two-thirds or even three-quarters of the shoe would be on the inside of the line. Low-cut shoes are much to be preferred, since they in no

way interfere with free motion and development of the ankle muscles.

Given a person with well-developed muscles of the leg, ankle and foot, a foot that touches the ground correctly in a properly constructed shoe to his fit and walks straight ahead like the Indian and uses his knee joints, it is not at all likely that person will ever have foot trouble or defective joints above the foot.

Shoes are usually selected to please the eye and the foot is deformed to fit the shoe. Commercialism is intensely prevalent in the shoe industry and the human foot is made the "goat." The heel was originally intended to prevent the horseman's foot from going through the stirrup of the saddle; at present it is a mark of style. If one point of the tripod—the heel—be raised two or three inches the entire weight of the body is thrown on the other points of the tripod, and, if persisted, will cause a dropping or flattening of the anterior arch. This frequently causes the very painful Morton toe and always a shortening of the extensor tendons and hammer toes. If the shoe be point-toed there usually is a misplaced outward big toe and hallux valgus, with an overlying bunion and occasionally ingrowing toe nail. Such a foot causes sprung knees and probably a pain the back.

There is a type of shoe commonly called the straight last. The heel may be broad and flat, but the toe is usually pointed and the line of normal safety bisects the front of the shoe about equally. Such a shoe will cause a bend at the astragalonavicular articulation, a pronation or rotation of the foot inward and a dropped longitudinal arch. This shoe usually causes an eversion of the foot (the unfortunate outward toeing), while the high heel may also do so. The same deformities in the front part of the foot caused by the high heel are not quite so universal, but quite likely to occur.

There is an old saying that when your feet hurt you hurt all over; it might as truthfully be said that when your feet are deformed there is likely to be some deformity elsewhere in the body. How frequently we find one knee sprung and bucked

knees associated with and relieved by correcting flat-feet. Almost as frequently do we observe some abnormality of the lumbar and sacro-iliac regions caused by bad feet, and occasionally round shoulders are corrected by better feet.

It would seem, then, that it is quite necessary for one to have good feet, that he may have good joints elsewhere; that the framework of the body should be correct; that the musculature of the body can be well developed. An examination of many athletes will prove this statement. Is it not possible and necessary for an individual to have good feet, good joints and well-developed muscles, especially of the back and abdomen, to prevent a visceroptosis? It is.

DISCUSSION

Dr. Charles H. Mayo, Rochester, Minnesota. — Dr. Carothers has presented to us, I believe, a very good and useful paper. The large number of surgeons in Washington who said they would like to become orthopedists was surprising to me, and I hope enough of them will carry out the wish so that they can at least exert their influence to change the people's attitude toward shoes. Moreover, they should try to exercise their influence on manufacturers to have shoes made to fit feet in a normal condition. Young persons are inclined to wear shoes that are a size too small rather than a size too large. It is a matter of pride with them. But as we get older and have twice the weight to carry, we appreciate the importance of normal feet much more than we did when we were young. The added weight to a deformed foot means added discomfort. One man recently gave considerable trouble in trying to break into the Surgeon-General's Office by way of the senate chamber in order to have podiatry put on a par with surgery. If such men will stick to that purpose and practice podiatry, and shoe-fitting in cases of deformed feet it would be all right.

PSEUDOMYXOMA PERITONEI

By M. H. Biggs, M.D.
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This disease was first described by Werth in 1884 as pseudomyxoma peritonei, but has received scant mention in the English language, and few cases have been reported by American writers. A general review of the literature, however, shows that its recognition is becoming more frequent.

I operated on my first case in 1907 and was able to keep this patient under observation until her death in 1916. The nature of the condition was recognized and a confirmatory pathological report secured. Since that time I have operated on five other cases in which microscopic examinations have been made, and one case, not included in this series, in which the specimen was lost, but clinically there was no doubt as to the diagnosis. All specimens have been examined in the laboratory of gynecology of the University of Pennsylvania, pathological reports having been made in the first case by Dr. B. M. Anspach and in the other five cases by Dr. C. C. Norris. Only a few weeks ago my colleague, Dr. Henry Norris, operated for this condition, and the patient has made a most satisfactory recovery.

Pseudomyxoma peritonei may be described as an inflammation or irritation of the peritoneum, caused by the discharge of the epithelial lining and the contents of a pseudomyxomatous cyst of the ovary or appendix, and resulting in the production of pseudomucin and secondary tumor formation.

The pathology of this condition, even today, is ill-defined, but in some of its phases it is particularly interesting. Quoting

from the original paper by Werth: "The gelatinous contents of the cysts contain chemical substances which are not soluble in water, and cannot, therefore, be absorbed by the peritoneum. Even if the peritoneum could absorb these substances they could not be carried in the lymph channels, because these spaces would become obstructed. Therefore, these remain and travel into all parts of the peritoneal cavity on account of the peristaltic activity of the intestine. They act as foreign bodies on the serosa and stimulate the formation of new vessels and connective tissue."

In contradistinction to this original view of Werth, Olshausen, Pfannenstiel and others believe that the process is an implantation metastasis from a primary ovarian tumor, while Fraenkel states that the metastases are not complications but are part of the original process. In a contribution to the subject by Goldschmid he states that gynecologists have held that it was a true metastasis from displacement of epithelial cells with new growth of mucous masses, while anatomists have held that it was merely the organization of mucous masses from the tumor.

To my mind the most tenable theory as to etiology is that of cellular implantation, the epithelial cells lining the cyst, together with the pseudomucinous content of the cyst, being discharged through a rupture of the cyst wall into the peritoneal cavity, and the cells there functioning as they did in their original situation.

We must attempt to explain the rupture of pseudomucinous cysts without the production of pseudomyxoma. That this frequently happens cannot be doubted. Rupture of the ovarian cyst usually occurs in the larger loculi, which are distended, the walls are thinned and the point of rupture is lined by partially degenerated or comparatively inactive epithelial cells. Few cells are liable to be discharged with the pseudomucin, and these cells are not good plants. Further, as a rule, the loculi in which the fluid is not under much tension are lined by columnar epithelial cells that are very active. These cells usually appear to be rather firmly attached to their basement

membrane and are not easily displaced, so that even if the smaller loculi are ruptured, few if any epithelial cells may escape. These facts probably account for the comparative rarity with which pseudomyxoma develops even when there has been rupture and sufficient time has elapsed prior to operation or death to allow for growth. Active cells are not the rule in the appendix, but are almost constant in pseudomyxomatous cysts of both the appendix and ovary, and they are often loaded with pseudomucin. When they are discharged in larger number than can be resisted or destroyed by the peritoneum they become attached, grow, function and cause pseudomyxoma. A close study of cases will show that the new growth follows the primary form in histological characteristics and produces the same type of material.

At first this condition was considered, in every instance, to be the sequel to a previously existing ovarian cyst, but it remained for Fraenkel, in 1901, to observe that the appendix may be the seat of the primary pathology. In numerous reported cases in which both an ovary and the appendix were the seats of this condition it has been demonstrated that they were independent in origin. In my series the appendix was affected in three cases, of which two showed transplants, and in one it was the seat of a mucocele. Secondary involvement of the appendix is not remarkable, as any organ covered by peritoneum can be attacked.

I would say that pseudomyxoma has no distinctive symptomatology, except when the lesions are advanced and widespread. The symptoms manifested are usually those due to mechanical interference with function and may be caused by blocking or closure of the lymph spaces, cutting off of the blood supply, thickening of the peritoneal covering of organs resulting in tumor formation on their surfaces and encroaching on functionating tissue. Constriction of the intestine is not uncommon. Early cases will be discovered at operation; late cases presenting effusion with irregular, firm tumor formations distributed throughout the abdominal cavity can be diagnosed preoperatively.

The early history of these cases can yield but little information other than that pointing to the existence of an ovarian cyst or a chronically diseased appendix. Ordinarily the statements of the patient when first seen are not helpful, as is illustrated by the following list of "Reasons for Seeking the Surgeon," in my series: Case 1. Distention, weight, pain, shortness of breath. Case 2. Uterine bleeding from multiple myomata. Case 3. Pain, abdominal distention, vomiting, fever, loss of weight. Case 4. Pelvic pain, backache, weakness, loss of flesh, constipation. Case 5. Pain in left side and pelvis, bearing-down feeling, indigestion, loss of weight, menorrhagia. Case 6. Fulness of stomach after eating, distended abdomen, frequent micturition, slight pelvic pain. Only in the terminal stages will the patient show weakness, loss of weight and an appearance bordering on cachexia.

The age of the patient is an aid in establishing the diagnosis. While there are a few instances of its occurrence in earlier years, it is generally seen in the female in advanced life, after the menopause and at a time when many lesions of the female genitalia can be excluded. My youngest patient was forty-one years and the oldest seventy-eight years, the average being over sixty.

Statistics do not seem to help us in determining whether the course is rapid or slow, but a logical deduction from reported cases and those personally observed would be that it is not rapid until well advanced and when a part of the original growth has been left at operation. Even at this stage it may be slow, as in case one of this series, which was by far the most severe when first seen, and death did not result for nine years. The other five cases are living at periods of twenty-eight months, twenty-six months, sixteen months, twenty-two months and twenty-five months after operation. In two of the cases there was recurrence: one after twenty-six months and the other after seven years. Strangely the time of recurrence does not seem to bear any relation to the severity of the lesions.

I feel much more optimistic regarding the outcome of these cases than some previous writers. It will be found stated that

recurrence is early, that the incisions are liable to become infected, that pseudomucin is a good culture medium, that the operation is unusually hazardous and that it should be regarded as a form of cancer. My operative results do not justify these statements. Of the cases here reported the earliest recurrence was in twenty-six months; in no case was the wound infected, although in one case twelve operations were done; intra-abdominal suppuration did not occur; there was no operative mortality, the only death being nine years after the patient was first seen, at which time there were large tumor masses throughout the abdomen.

Weighing against malignancy also is the fact that it is not a rapidly destructive process. Multiple metastases may be widely distributed, and the wall of the original cyst, which perhaps has been existent for years, remains intact. The process is not destructive to tissue in the way that is seen in cancer. In only one of my cases was the microscopic appearance even suggestive of malignancy. She was seventy-two years old, is now living, has had no recurrence after more than two years and reports a gain of between fifty and sixty pounds in weight.

The findings at operation vary in wide degree. In all the reported cases to which I have had access there has been a cyst, either of the appendix or ovary, or both. There is present more or less pseudomucin, which in color is a shade of yellow; in consistency it may be thin, viscid, jelly-like or thick, tenacious and stringy and it may contain sago-like bodies. If in small quantity it will be free in the pelvis. In larger quantity it may show all the characteristics mentioned, it will be distributed like any effusion, is apt to cling to the peritoneum and the thicker portion is removed with difficulty. The largest quantity that I have removed at one operation was thirty-five pounds and the largest total removed from one patient was three hundred and fifty pounds at twelve operations.

In late cases there will be actual tumors on the abdominal viscera and great thickening of tissues. I have seen almost the entire colon enormously enlarged, covered by cysts and nodular formations, and the mesocolon from one-half to one inch thick.

These new formations are hard to describe, but once seen will not be confused with other conditions. They may be made up of small cysts of varying sizes and embedded in indurated but edematous-appearing structure, and are rather whitish and opaque.

I have noted in my cases that the peritoneum surrounding these secondary growths, as well as that under the jelly-like material in earlier cases, did not simply resemble an inflammation but bore a stippled or rather fine pebbly appearance, without actual macroscopic cystic formation. This I believe to be the early stage of pseudomucinous development in the peritoneum, and when present, together with gelatinous material, I think we may say we are dealing with pseudomyxoma peritonei. That the lesion need not present a striking appearance to be potent is well illustrated by a case reported by Eden, which he operated on twice. At the first operation he mentions the exudate and says, "This jelly-like material was adherent to the peritoneum, which in turn was injected." At a second operation, two years later, the opposite ovary and the appendix were the sites of advanced lesions. Unless the pseudomucin and cellular elements have been deposited very recently, or are impotent, I think that careful observation will show not only injection but the rather diagnostic pebbly appearance of the peritoneum, which is an early stage of cystic development.

It has been pointed out by others, and my observation verifies the view, that all the original tumor should be removed if possible. This is sometimes difficult and even unattainable when adhesions are very firm and highly vascularized. In the only case in which I was compelled to leave a portion of the original cyst wall deep in the pelvis and adherent to the rectum, there was recurrence in slightly over two years. It is unfortunate that the secondary formations cannot always be removed, both to accomplish a cure and for sectioning, the hollow viscera seeming to be most frequently attacked. From one patient I removed a section of the mesentery for examination without any ill results.

If the original lesion is entirely extirpated, all pseudomucin

removed and affected areas of the peritoneum carefully wiped off with wet gauze I believe that in early cases cures will often result, and certainly the patients may be free from recurrence for many years. It is probably true that what we look for we see; certainly in pseudomyxoma peritonei I see a grave condition, curable in its early stage, and constituting another and very mandatory indication for the removal of an ovarian cyst or a diseased appendix.

CONCLUSIONS.—1. This condition is much more frequent than is generally recognized.

2. It is caused by cellular implantation.

3. It is histologically benign, but may be clinically malignant.

4. If it is considered to be a form of cancer it must be assumed that pseudomucin inhibits its destructive power.

5. It may originate in the ovary or the intestinal tract, ovarian origin being by far the most frequent.

6. If it is appendicular in origin the appendix has been the seat of chronic inflammation.

7. Early invasion of the peritoneum is characterized by a pebbly appearance.

8. In early cases the condition will sometimes be cured, and at any stage it may be inhibited, by operation.

REFERENCES

Werth: Arch. f. Gyn., 1884, xxiv, 100.
Olshausen: Krankheiten der Ovarien, 1886.
Pfannenstiel: Handb. d. Gyn., iii, 335.
Goldschmid: Arb. a. d. Geb. d. path. Anat. u. Bakteriol. Festschr. f. P. v. Baumgarten-Tübigen, 1914, lx, 175.
Fraenkel: München. med. Wchnschr., 1901, xxiv, 965.
Eden: Lancet, 1912, xi, 1498.

PSEUDOMYXOMA PERITONEI IN MALE SUBJECTS

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There is a sufficiently large number of recorded cases of pseudomyxoma peritonei to remove this disease from the category of rarities, but nevertheless the number of studied cases is too small to furnish a satisfactory concept of the exact nature of this pathological process.

The striking, outstanding and characterizing feature of the disease is the accumulation in the peritoneal cavity of a colloid exudate, varying in consistency from a syrup to solid colloid masses. This exudate is the only constant accompaniment of the disease. In some instances there is a progressive cachexia leading to death; in others the disease runs a benign course, with perfect recovery after suitable operative procedure and often doubtlessly without operation. In the vast majority of cases the primary cause of the disease is the rupture of the pseudomucinous ovarian cyst; in a by no means small minority of cases the cause is the rupture of a mucocele of the appendix. Up to date the latter cause is the only one that has been found to be responsible for the disease as it occurs in males. In some cases the colloid material is confined in loculi whose walls are made up of a connective tissue new growth so firm and abundant that it fuses all the viscera into a solid mass—molded, as it were, into the peritoneal cavity. Some authors consider this process as a type of plastic, foreign-body peritonitis; others consider it as secondary myxomatous degeneration of the peritoneum; others as multiple cystic lymphangiomata; others as a

type of innocent implantation metastasis; others as frank carcinosis peritonei, and still others as a specific type of peritoneal infection producing mucin. Virchow named the disease peritonitis gelatinosa or peritonitis myxomatosa chronica; Pean called it maladie gelatineuse du peritone; Vidal called it peritonite collide; Werth finally coined the term pseudomyxoma peritonei, basing it on Hammarsten's proof that the exudate was made up of pseudomucin, instead of mucin.

This by way of a short introduction suffices to emphasize both the interest that centers in the disease and the need of accurate case reports, in order to foster further study. My own experience has been limited to two cases, one of them already reported by Dr. Guthrie McConnell[1], pathologist to the Skin and Cancer Hospital of St. Louis, occurring in male patients, with the appendix as the primary seat of the disease. I shall therefore limit my discussion to pseudomyxoma as it occurs in the male, appending a detailed case history and autopsy as a matter of record. This limitation to male patients is made in order to emphasize the role of the appendix as a primary focus, from which, as a central depot, the disease may spread to and involve the entire peritoneum.

It may be reasonably assumed that a knowledge of pseudomucinous cysts of the ovary is fairly general. The danger of rupture of this variety of cyst and likewise of the papillary cystadenoma of the ovary is almost universally appreciated, and the technic of the removal of these cysts has in late years been modified to meet these dangers. By no means may as much be said regarding the knowledge of the profession in regard to mucocele (so-called cystic degeneration of the appendix) or to diverticula of the appendix. A discussion of pseudomyxoma peritonei in the male will serve very concretely to emphasize both the importance and gravity of what we might otherwise casually consider as a mildly inconsequential appendicular lesion.

The pathology of pseudomyxoma peritonei is, in the very

[1] International Clinics, vol. xiv, seventeenth series.

first instance, striking, and, as far as I know, unique, in that the disease may run a benign or a malignant course clinically without furnishing any differentiating criteria, macroscopically or microscopically. The outstanding feature of the disease, pathologically, is the accumulation of a gelatinous material, which on analysis has been shown by Hammarsten and others to be pseudomucin. The gelatinous material may be found circumscribed in the right iliac fossa or it may be scattered widely throughout the peritoneal cavity. So far no recorded case of pseudomyxoma in the male has shown any other source than the appendix as the primary source of the gelatinous material. Kaufmann, who refers to the disease as pseudomyxoma peritonei ex appendice, classifies the possible origins of the pseudomucin as from: (*a*) the rupture of a cystic appendix; (*b*) the rupture of a diverticulum of the appendix; (*c*) perforation of an acutely inflamed appendix. This last possibility is open to very grave doubt for the reason that the contents of an acutely ruptured appendix is purulent rather than mucinous. Elbe has shown that the essential conditions for mucinous dilatation of the appendix are a rapidly stenosing process, a sterile lumen and an actively secreting mucosa.

The important fact is that the appendix itself is the sole responsible agent for the disease as we encounter it in the male. It is the responsible agent, because under certain definite conditions the lumen of the appendix or diverticula therefrom contain pseudomucin and epithelial cells. It has not been established whether the escaped pseudomucin provokes a reactionary pseudomucinous peritonitis or a myxomatous peritoneal degeneration or whether the escaped epithelial cells are originally responsible for the pseudomucin, and continue to manufacture it after their spread and implantation throughout the peritoneal cavity. In this connection it is significant, to quote the figures of Elbe, showing that in 7602 routine autopsies cystic appendices were encountered 33 times (nearly 0.5 per cent.), and that in 2654 operations for appendicitis, cystic appendices were found 17 times (nearly 0.7 per cent.).

The course of events following the escape of the pseudomucin varies:

1. The exudate may be limited in its escape to the right iliac fossa, where it constitutes itself as a saucer-like, kidney-like or sausage-like mass, that is slowly encapsulated by connective-tissue growth. The connective-tissue growth tends from the outset to infiltrate into the mass as tiny tendrils, the tendrils growing into well-developed strands later. The mass of pseudomucin is usually coursed with fine bloodvessels and frequently peppered with small hemorrhages. The connective-tissue capsule tends to establish firm adhesion to the neighboring peritoneum.

2. The exudate may not be localized to the right iliac fossa, but may escape to various and multiple intraperitoneal sites, setting up the typical peritoneal productive reaction which results in the loculation of the pseudomucin into cyst-like cavities to which neighboring peritonealized structures become adherent. Sometimes in this form of spread the pseudomucin becomes delicately encapsulated and hangs from the intestinal peritoneum as little polypi.

3. It is possible for the exudate to be absorbed entirely. Lejars reports such instances, and I have under observation at present a patient who in all probability is absorbing a pseudomyxomatous mass.

4. A widely disseminated spread of the exudate, with a tendency to marked secreting activity on the part of the disseminated material. These are the cases that present the clinical appearances of an ascitic abdomen, with accompanying symptoms of cachexia and general physical deterioration. In this group we may encounter infiltration of the abdominal wall. In spite of all these ear-marks of malignancy, there is clear-cut, clinical evidence of the benign nature of this type of the disease in several instances. In other recorded cases this type of the disease has carried patients off exactly as does widespread intra-abdominal carcinosis. In these cases, in which the dissemination is widespread, there is an accompanying adhesive peritonitis which tends to bind and fuse all the intra-abdominal organs into an inseparable mass. Kinking of the intestine, and consequent intestinal obstruction, naturally is a likely complication.

From the histopathological point of view the chief interest centers around the fate of the epithelial cells, which usually spread with the exudate. According to Cagnetto the contents of a cystic appendix are made up of mucus, leukocytes and epithelial cells. The epithelial cells are usually found lining the various cyst cavities and vary in size from low cuboidal to high cylindrical. By some authors they are made responsible for the metastatic secretion of the pseudomucin; by others this origin of the exudate is denied. It is fairly generally conceded that, as the pseudomucinous exudate accumulates within the new-formed connective-tissue capsule, the intracapsular pressure destroys the epithelial lining. If this be a correct assumption it introduces an element of confusion in establishing definite criteria by which we may establish a diagnosis of carcinoma. In the present state of our knowledge it is futile to speculate on this problem[1]. The facts are that certain cases of pseudomyxoma, showing an abundant distribution of epithelium, recover completely after incomplete operation, and other cases in which, although it is almost impossible to find any epithelial cells, the disease runs a clinical course identical with carcinoma.

The symptomatology of the disease varies within broad limits, according to the stage to which it has progressed and the type of pathological course that it follows. It seems rational to assume that the most benign types, due to a ruptured sterile appendicular cyst, may run its course symptomless, the exudate being absorbed without ever having made its presence known. There are other cases of mild abdominal symptoms in which the sausage- or kidney-shaped tumor, found in the right iliac fossa, constitutes the most important

[1] This question is clouded by two case reports (Hueter and Kaufmann) in each of which pseudomyxoma, leading to death with manifest clinical evidences of cachexia, was accompanied by carcinoma of the appendix. Both these authors contend that the cases could be differentiated from colloid carcinoma of the peritoneum on the basis of scanty cell distribution. I cannot bring myself to believe that in either of these cases, or in the case reported by McConnell, there is sufficient warrant to exclude carcinoma.

symptom. These cases shade off clinically into the more grave cases with distended abdomen, multiple palpable masses and signs of general physical deterioration. In no case is there a satisfactory syndrome in which to base a diagnosis with any degree of assurance. In my second case I was able to make the diagnosis tentatively, owing to the fact that the patient's appendix had been removed at an earlier date for some unknown type of appendicular disease, that a postoperative fistula had established itself, and that from this fistula, when I examined the patient, there exuded a thin mucinous exudate.

The prognosis of the disease varies from excellent to hopeless. As a rule, it may be stated that if operative interference is instituted early before wide dissemination has occurred a cure may be expected regularly. The widely disseminated types (irrespective of whether subsequent investigation classes this type as pseudomyxoma or as carcinoma) offer the most hopeless outlook.

Treatment consists in removing the primary focus of disease —the appendix—and scooping out that portion of the exudate, which can be reached conveniently and with safety, without any attempt to clear the abdominal cavity of its entire pseudomucinous content.

The following case is appended as a matter of record:

Present History. Patient, a male, white, aged forty-two years, entered City Hospital on December 12, 1912, complaining of abdominal pain, abdominal distention, weakness and loss of weight. About two years ago patient gradually developed a dull, intermittent pain in the region of the umbilicus, coming on about one-half hour after meals, and a feeling of discomfort between these attacks. At this time, however, there were no gastric symptoms such as pain, eructations, nausea or vomiting, and the appetite was good. The bowels were constipated, three days having often elapsed without a movement. This condition continued with very little variation for about one-half year, when, after a fishing trip, the patient returned home with a more or less severe cramp-like pain in the lower left abdomen. This lasted all day and finally compelled him

to call in a doctor, who gave relief by the use of some tablets and a physic. At this time no other symptoms had developed. Five months after this attack the patient noticed that his abdomen began to enlarge. This continued while the patient became thinner. Doctor then told patient that he had dropsy and would have to be tapped. In October, 1912, the patient consented to an operation, which was done under an anesthetic, and in which he presumed some fluid was removed. For two or three months previous to this operation patient had attacks of vomiting usually in the morning, but occasionally at various times during the day. On inquiry it was learned that the operating surgeon had diagnosed the case appendicitis and had operated on that basis. Other details could not be learned from the physician, who had not kept a record of the case. The patient stated that the wound was slow to heal after the operation, and that the dressings were saturated with a clear yellow fluid which looked like urine. This discharge continued for a week. Three weeks after the operation he walked home. Still weak at this time, he remained in bed, getting up only occasionally; becoming progessively weaker, he finally entered the City Hospital on the above date.

Family History. Patient's father is dead, the cause of death being unknown. His mother died of tumor, the nature of which is unknown. There was no history of tuberculosis, nervous or mental diseases, skin diseases, rheumatism, nephritis or cardiac conditions, etc.

Past History. Patient had measles, parotitis and varicella in childhood. Had an attack of rheumatism three years ago. Had gonorrhea once in his younger days, and had a small sore on his penis several years ago, which was not followed by a skin eruption, sore-throat, falling of hair or other symptoms of secondary lues. Had been operated upon as mentioned above. No history of any accidents.

Habits. Bowels more or less constipated. Sleeps poorly and somewhat irregularly. His occupation was that of a shoeworker. Drank beer and whisky to excess some years ago, but more moderately for the last few years. Used smoking tobacco.

Denied the use of drugs. Diet and hygiene were found to be only fair.

Physical Examination. An emaciated anemic white male about five feet ten inches tall. Development and nutrition poor. No deformities. Somewhat depressed both mentally and physically, although apparently contented.

Head and Neck. Light brown hair, gray eyes, left pupil larger than right, somewhat irregular and both reacted sluggishly to light. No nasal or oral findings. No facial palsy. The tongue was central, clear and presented a slight fine tremor. No cervical pulsations. Cervical lymph nodes palpable.

Thorax. Flat chest; anteroposterior diameter somewhat diminished in proportion. Emaciation quite evident. Apex-beat seen and felt in normal position. No increase in tactile fremitus. No increase or diminution in vocal fremitus. No abnormal areas of dulness on percussion. Tubular breathing throughout the thorax. No rales. No cardiac murmurs.

Abdomen. Considerably enlarged and ovoid. Firm but no marked tension. Slight tenderness on deep palpation, not well defined. On palpation the abdomen gave the impression of a general abdominal mass extending to the right and left, moderately firm in consistency, irregular and ill defined and not very movable. No fluid percussion wave. Rectal examination elicited an ill-defined, firm mass in the region of the prostate. Abdominal skin reflexes equal but somewhat sluggish. The abdominal organs could not be outlined. Inguinal glands palpable. A discharging sinus in a linear scar below the umbilicus and in the midline, the discharge being yellowish in color, and mucoid in consistency.

Extremities. No deformities or paralysis. General weakness. No disturbance of skin sensations. Pulse fairly full, regular and of good tension.

Urinalysis. Specific gravity 1023; acid, cloudy, amber, no albumin or casts. Uric acid and urate cystals. Blood examination: Positive Wassermann reaction. Fecal examination: No blood observed after a meat-free diet.

Diagnosis. Syphilis, malignancy (?), pseudomyxoma peritonei (?). The last two conditions are strongly suspected on account of the general condition of the patient, the abdominal physical findings, the nature of the discharge and the history of an appendectomy.

Course. Treatment was begun along a dietetic basis, efforts being made to increase the patient's resistance; hence stomachics, tonics and a liberal diet were ordered. The sinus was regularly dressed with an aseptic dry dressing. Within a week the positive Wassermann was obtained and the mixed treatment of potassium iodide and injections of mercuric bichloride solution was instituted. At the end of a month of this treatment, patient's general condition was improved with no marked change of the local condition. Then salvarsan was injected intraveneously, which resulted in the discharge becoming more profuse for a few days, but after a week the abdomen had become considerably smaller, the discharge became less and the patient generally improved. This improvement did not last long when, at the beginning of the third month of treatment, it was noticed that both legs became more and more edematous, and finally skin excoriations were seen. The etiology of this was ascertained as disturbed circulation. In the meantime the discharge from the sinus became more profuse. About fifteen days' treatment by rest in bed, elevation of the limbs and local applications of zinc oxide ointment caused the leg condition to disappear, but the discharge from the sinus became more profuse. In a few days the patient was put into a wheel chair again, but his general condition was found to be worse, with loss of appetite and pallor and emaciation more marked. Five days later the abdominal sinus became a fecal fistula and with it came weakness and so much exhaustion that the patient was obliged again to take to his bed. From this time on, patient became progressively weaker, the discharge from the fistula became more profuse and the pulse became so weak that digitalis was given. Cardiac stimulation finally proved fruitless, and, unable to talk from the marked weakness and collapse, the patient finally died of exhaustion February 23, 1913.

Autopsy Report (*by Dr. D. L. Harris*). The body is that of an extremely emaciated white male, measuring 165 cm. Rigor mortis absent; livores very few in the dependent parts of the body. Eyes are deeply fallen in. Intra-ocular pressure slightly reduced; pupils equal, measuring 0.4 cm. Body very pale; skin over both limbs dry and scaly. Abdomen slightly distended. Umbilicus cannot be seen. In the median line about the middle of the abdomen there is an opening measuring 0.4 cm., oval in shape, through which greenish yellow semifluid, creamy-like material is exuding. On opening the abdomen, panniculus nearly absent; muscles very thin, brownish red. The abdominal cavity is filled with a greenish yellow gelatinous mass, which covers the intestines and all the organs. In the dependent parts of the pelvis and in both hypochrondria there is a considerable amount of a semifluid material of a feculent odor and pea soup-like appearance. The viscera cannot be separated from one another; the liver is attached to the diaphragm, or rather separated from the diaphragm, by a thick layer of this half-translucent, jelly-like material. This layer measures from 5 to 10 cm. The intestines are all bound together in one mass, and the coils are so firmly adherent each to the other that, in trying to separate the same, their walls tear and feces exude. The intestines are of a light gray, distended with gas and very thin. Appendix cannot be seen or found. The omentum and stomach are concealed under the jelly-like mass, and the contour of the stomach cannot be felt. Bladder is distended above symphysis and is filled with clear urine. The surrounding tissue and prostate are very firm and covered by numerous yellowish white nodules, which are prominent, moderately firm in consistency and have the size from a pinhead to a small pea. They are not transparent and appear cheese-like. They differ very much from the translucent jelly which covers the peritoneal cavity and organs. The organs are taken out *in toto,* and large cross-sections made through the entire mass. Only the kidneys could be separated from this mass. Each of these organs is very small (100 g.). Capsule strips easily, leaving a perfectly smooth surface of a reddish yellow color.

The cut surface shows regular structure. Cortex and medulla are pale. Glomeruli are visible and pyramids distinct. The pelvis is moderately extended, mucosa pale. On the left kidney there was found a small white nodule, measuring 1 mm., of a yellowish color and opaque. Spleen cannot be separated and cross-sections show a very firm grayish organ, whose cut surface has a honeycombed appearance, due to very much thickened septa, between which are small whitish cysts either empty or filled with the jelly-like material. The organ is very firm and cuts with difficulty. Section through the liver shows a very thin dark brown organ, slightly increased in consistency. The liver structure cannot be distinctly made out. The liver, as mentioned above, is surrounded by a thick layer of the jelly-like material. Sections of the pancreas show a very firm organ, pale yellow in color and smaller than usual. The mucosa of the stomach is pale. On removing the sternum, both lungs are moderately contracted, partly covering the heart. Pericardial sac is very thin, smooth and shining. It contains several cubic centimeters of a clear fluid. Heart is small, much smaller than the owner's fist, and weighs 190 gms. The right side is flabby; left moderately contracted. The epicardium is free, smooth and shiny, of a reddish, brownish color. The mitral scarcely admits two fingers. The tricuspid easily admits three fingers. The myocardium is brownish and measures 1.2 cm. thick in the right side. Bicuspid and tricuspid valves are smooth and tender. The aortic cusps are tender. The wall of the aorta shows multiple irregular patches, measuring from 1 to 3 cm. They are prominent, white, opaque in color and not calcified. The elasticity of the aorta is still present. Right lung weighs 370 gms. Left, the same. Pleural surfaces perfectly smooth. The lungs are grayish pink in the upper parts and reddish in the lower. Both organs pit on pressure. On cut surface upper lobes are grayish. Middle and lower lobes are red, congested and, on slight pressure, frothy, blood-stained fluid is exuding in abundance. Bronchi moderately congested, filled with frothy fluid. Bronchial glands are not enlarged and slightly anthracotic. Brain: Dura mater of

a good tension; gyri are not flattened. Ventricles contain usual amount of clear liquor. Consistency of the organ not diminished. On cutting, tissue appears rather pale and blood points are not numerous.

Anatomical Diagnosis. Pseudomyxoma peritonei. Peritonitis chronica (with purulent and fecal exudate in abdomen). Brown atrophy of the heart. Early arteriosclerosis of aorta. Edema of the lungs.

Microscopic Findings. Sections from the omentum, intestine, spleen, kidneys, liver, pancreas, bladder and diaphragm and from the lungs and heart were made. Microscopical examination of these shows the process to involve only the peritoneum and the parenchyma of the spleen. Within the substance of the liver, kidney and pancreas there is none of the myxomatous material. The process does not extend beneath the visceral peritoneal layer of the intestines. Sections of the omentum show a marked fibrous connective-tissue proliferation with numerous areas of extensive lymphatic infiltration. Covering this in varying degrees of thickness are laminated, cell-free layers of unformed material, which stain faintly and diffusely. Numerous cysts here and there are lined with a single layer of epithelial cells, which, in proportion to the distention, are either tall, columnar, cuboidal or flattened. These epithelial cells may be found in all degrees of deterioration. In larger cysts, where the stratified myxomatous material is more extensive, only the faint outline of these cells is discernible. In one section, which included the liver, the diaphragm and the thickened intraperitoneal deposit, Glisson's capsule and the peritoneum covering the liver is easily made out. Upon this, lying within the fibrous tissue bands, are small cysts containing within their walls the mucinous deposit. These cysts are lined with a single layer of cuboidal and columnar epithelial cells. In the omentum there is an extensive deposit of the mucinous material held within a connective-tissue meshwork. There are here numerous areas of lymphatic infiltration. The spleen can scarcely be recognized. Only a few scattered islands of lymphoid tissue mark its site. The fibrous

connective tissue in growth is here especially marked. The epithelial cells lining the cysts are preserved only here and there. For the most part merely a faint and obliterated outline of these cells remains. It appears that degeneration follows as rapidly as proliferation advances and that in this we have one explanation of the chronic nature of the disease. These cuboidal epithelial cells are always in a single layer and do not grow upon stalks or tend to form papillary outgrowths. Very few goblet cells were observed.

DISCUSSION OF PAPERS OF DRS. BIGGS AND SEELIG

Dr. Reuben Peterson, Ann Arbor, Michigan.—I have had no experience with pseudomyxoma peritonei due to changes in the appendix, but I have had quite a fairly extensive experience with the other type of the disease. I can recall at least 5 cases associated with ruptured ovarian cysts containing colloid material which was in most of the cases extremely sticky in character and filled the abdominal cavity to a greater or less extent. In some cases this material was ropy and had to be pulled out of the peritoneal cavity, leaving the peritoneum reddened and thickened. In one of the cases where the pseudomyxoma peritonei followed the rupture of a bilateral papilliferous cystadenoma there were, in addition to the 3000 c.c. of colloid material, what appeared to be implantation metastases scattered over the parietal peritoneum and surface of the intestines. The specimen was pronounced malignant by the pathologist, yet five years later the patient was in perfect health.

I have had a recent case with rather unusual findings which I wish to place on record. The patient was a woman of thirty-seven, who was operated upon last April for an ovarian cyst. The surgeon found a ruptured cyst, very adherent and a large amount of mucilage-like material in the abdominal cavity. The ascitic collection was removed, but the adherent cyst was not disturbed. The patient did very well until August when she became rapidly worse. Upon entrance to the University Hos-

pital the last of September she gave every appearance of an extremely sick patient. The abdomen was markedly distended and tender, the pulse was 130, and there was extreme dyspnea due to the distended abdomen and a bilateral pleural effusion. Her condition was so serious that it was considered inadvisable to attempt the abdominal operation until after aspiration of each pleural cavity, from which a quart and a half of fluid was removed, which contained pseudomucin, proved to be such by careful chemical tests. After the aspiration of the pleural cavities the patient's condition improved sufficiently to allow of the abdominal operation. The abdominal cavity contained about two gallons of thickish fluid of the same character as had been aspirated from the pleural cavities, and proved to be pseudomucin by chemical tests. The peritoneum was reddened but not thickened and there were no metastases. The fluid had evidently originated from a ruptured papilliferous cyst of the right ovary, the size of an adult head, which was firmly fixed in the pelvis by rather dense adhesions. The fluid in this cyst also contained pseudomucin.

I see no other explanation of the presence of the pseudomucinous fluid in the pleural cavities than by absorption by way of the diaphragm from the abdominal cavity. A somewhat hasty review of the literature fails to reveal a case similar to the one described. Although the specimen has been pronounced malignant by the pathologist, bearing in mind the other case with the same findings which recovered, I am in hopes this patient, who has convalesced and is about to leave the hospital, will also be without a recurrence.

Dr. Thomas S. Cullen, Baltimore, Md.—The majority of the cases of pseudomyxoma peritonei that I have seen have been associated with bilateral ovarian tumors, and usually have been accompanied by changes in the appendix. Sometimes the appendix would be larger than one's thumb. Nearly all of these ovarian tumors that I have seen have been multilocular cysts with exceedingly thin walls, sometimes so thin that you could hardly touch them without causing rupture and quite a number of them had ruptured before operation. We found the same picture that has been so well described by Dr. Seelig, namely, a quantity of the sticky material all through the abdominal

cavity. On histological examination in the smaller cysts, as a rule, we were able to make out the high cylindrical or cuboidal epithelium. In the medium sized cysts much of the epithelium had literally melted and become transformed into the sticky material. In one case in particular which is pictured in Dr. Kelly's Operative Gynecology the omentum was several centimeters thick. It presented a cystic and honey-combed appearance.

Papillomata of the ovary form a most interesting group of tumors. In those cases where papillary masses spring from the ovary the operator cannot with any certainty give a prognosis. The pathologist is in precisely the same position. He may examine a small portion of the papillary growth and gather the impression that it is benign, but a distant portion of the growth may already show malignant changes and unless many blocks are taken it will be impossible for the laboratory man to give an accurate prognosis. The first case of papillocystoma of the ovaries that I ever reported had bilateral multilocular ovarian cysts with papillary masses projecting into the cysts and also projecting from the peritoneal surfaces. There were in addition papillary masses springing from the pelvic floor. These secondary masses were not removed. Fifteen years later the patient was well and had gained 49 pounds. In May, 1919, I had a somewhat similar case. We removed the ovarian tumors, but could not take out the secondary nodules. I saw the patient just a few days ago—the end is near. I am often amused at the attitude we as surgeons assume toward pathologists. Operators often make mistakes in diagnosis and are readily excused, but let the pathologist make an error in diagnosis and we are prone to remember it for years. We look upon him as well nigh infallible. If we expect the pathologist to give us his very best opinion, then it is incumbent on us to furnish him with all the data on the case that we possess.

I would like to say a word in reference to Dr. Peterson's case. In those cases where the myoma has partially or completely lost its connection with the uterus and where it receives the major portion of its blood supply from the omentum we will usually find a varying amount of ascitic fluid in the abdomen. The largest quantity I have ever seen was 51 liters. When the tumor has been removed and the fluid evacuated there is as a

rule no further accumulation in the abdomen. In 2 cases where partially parasitic myomata were associated with much free abdominal fluid there was also fluid in the pleural cavities. After the removal of the fibroids and of the abdominal fluid that in the chest disappeared.

Dr. Rudolph Matas, New Orleans, Louisiana.—This is an extremely fascinating subject to every surgeon who has had personal experience with cases of this kind and who has had to worry over the prognosis of this condition which is so closely linked with the pathogeny of the disease.

I have had four personal experiences with pseudomyxoma peritonei which have forcibly brought to my mind the difference in the prognosis of this condition regardless of the mode of treatment. Years ago I reported a most impressive case to the American Surgical Association at its meeting in this city in May, 1899.[1] It was a primary myxosarcoma of the great omentum, which was followed by myxomatous ascites fifteen months after extirpation of the entire neoplastic omentum in one solid block. These tumors of the omentum are seldom primary, but this was primary. When the omentum was extirpated, the peritoneum was filled with a clear ascitic fluid. The patient recovered from the operation, but in the course of a few months the ascites returned. I opened the cavity and found that it was filled with pseudomyxomatous material. This material, which had the consistency of thick glue, filled every recess and pocket of the peritoneum and had accumulated in enormous quantities. The patient had sought relief at various times by tapping his own abdomen with a penknife. The patient gradually passed away by exhaustion, cachexia and marasmus.

Not long ago I had an extraordinary surgical experience with a patient, whose pathology began with a pyelonephritis in an ectopic kidney complicated with multiple miliary abscesses of the kidney (colonic infection). I did a nephrectomy on March 24, 1910, from which she recovered. She became pregnant and on account of a contracted pelvis, Professor Lewis did a Cesarean section on August 12, 1911, with the delivery of a living child. The mother recovered and was seemingly in good health for three years when she began to develop a painless ascites, which

[1] See Transactions Philadelphia Medical Journal, December, 1899.

caused great abdominal distention. I could not determine the cause of the ascites, but suspected a malignant tumor. A laparotomy was performed in May, 1915, and showed the entire abdomen filled with a thick, gluey myxomatous material. The intestinal tract and all the abdominal organs were imbedded in this material. The appendix could not be found, as it was tangled in this ropy substance, but no primary neoplasm could be discovered, though it must be admitted that no very diligent or protracted search was made for it. I did nothing more than scoop out a bucketful of this material. The intestinal mass was held together by numerous adhesions and could not be exteriorized without risk of rupture. I removed a large quantity, enough to relieve all abdominal tension, but left behind a very considerable part of it, as I realized that a minute peritoneal toilet was impossible. I thought this patient was doomed, but she recovered and five years have elapsed and she has shown no signs of recurrence. The last development in her case was a colloidal or extrathyroidal cyst of the neck, about the size of a large hen's egg which I removed under local anesthesia in May, 1919. Thus far she has continued well.

In all the previous cases, the pseudomyxomatous ascites was clearly associated with, or secondary to, a primary or secondary neoplasm and all ultimately succumbed to the disease. In this case in which a peritoneal neoplasm was not recognized, the patient recovered. In three of the cases a pure serous ascites was transformed into a gelatinous mass which could be cut with a knife. Some substance is given off by the original neoplasm which transforms the clear serous fluid into a myxomatous material in a way we cannot explain.

Dr. M. H. Biggs (closing the discussion).—I do not believe I have anything to add except that I feel these cases ought to be put on record, and they will be published a little later with details.

CONGENITAL DIAPHRAGMATIC HERNIA, WITH REPORT OF A CASE

By Louis Frank, M.D.
Louisville, Ky.

Though Scudder, in 1912, could find only 53 cases of diaphragmatic hernia which had been subjected to operation, since then a number of cases have been recorded. We must still, however, conclude that those of congenital origin are exceedingly rare and do not often come to operation. More rare, for evident reasons, are those, whether congenital or traumatic, occurring on the right side.

A careful review of the literature since Scudder's paper reveals only 41 additional cases reported, and one of these a personal communication. We are forced to believe, however, from conversation with some of our roentgen-ray friends, that there have been others; but whether they occurred in adults, or whether they ever came to operation, I have no means of knowing.

Of the additional cases recorded in the literature only 5 were reported as congenital, those observed and operated upon being accounted for largely by the trauma of war. Most of the cases occurred in soldiers as the direct result of missiles. In this type of case also it is a fact, explained by the anatomical position of the liver, that the hernia was almost uniformly upon the left side. A study of these cases indicates that the abdominal method of approach is the most popular. This is easy to understand in cases of traumatic origin when a missile has entered the abdomen primarily. We find also that one

patient with congenital hernia was subjected to gastro-enterostomy, this being the only feasible procedure to obtain relief from urgent symptoms which were present.

Of the additional cases which I have collected 2 were observed postmortem. One was advised against operation, the pathology having existed without much discomfort, according to the history, for a period of forty-five years, the patient at the time of diagnosis and presentation being fifty-nine years of age.

In the description of diaphragmatic hernia there is nothing to surpass, either from an anatomical standpoint or from close study and analysis of the symptomatology in both strangulated and non-strangulated cases, that written by Cooper in his classical work on hernia published in 1804. He divides diaphragmatic hernia into three varieties, and I believe his division holds good today. He first classifies them into congenital and acquired. Under the congenital type he describes two varieties, one in which there is a distinct peritoneal sac, in the other there being no sac. The third variety also has no sac, this being entirely traumatic in origin.

A study of the literature confirms Cooper's opinion that congenital herniæ of the second variety are rarely seen, as the subjects usually die at birth or shortly afterward. In the first variety of the congenital type the individual may live for quite a period of years, and in his work Cooper mentions such cases, describing also cases of the second variety and of the traumatic type. Among the illustrations to be shown in connection with this paper there are three taken from Cooper's work. These were selected because of their excellence[1].

Beckman believed that the congenital type could be benefited by operation, and the opinion was then expressed repeatedly and set forth in text-books on surgery that such herniæ should

[1] There is nothing to be found in modern literature which equals the description of the clinical symptomatology of congenital, strangulated diaphragmatic hernia which appears in the work of this famous surgeon of bygone and almost forgotten days. Those interested will find much valuable information concerning the subject of hernia in general in his book published over one hundred years ago.

not be operated upon unless they become strangulated, and this seems to have been the general practice. Beckman says the congenital types are not true herniæ in that they have no sac. In the face of the reported cases, which have been carefully studied, this contention can hardly be maintained.

Giffin, in 1912, and Scudder, in the same year, reviewed most carefully and completely all the literature of this subject. At that time about one thousand cases had been recorded, though of these a very large proportion had been discovered only at autopsy. Scudder's study showed that there had been about 53 operations performed for diaphragmatic hernia at that time, and of this number 39 patients had died. The thoracic approach was used in 11, of which 7 recovered; the abdominal approach in 42, of which 35 died. In these 53 cases deliberate operation based upon preoperative diagnosis was performed in only 6, the other patients applied to the surgeon for relief of intestinal obstruction; and, as he says, this is most likely the cause of the high mortality. The case reported by Giffin, in 1912, is included as one of the 6, diagnosed prior to operation, though if I read the report of Beckman correctly 3 of his cases were also diagnosed before operation. We would recommend the articles of Giffin and Scudder to those who desire to pursue further studies of the literature of this subject.

Recently, as has already been said, probably as a result of war wounds, the subject has again been brought to the attention of the profession, particularly by Soresi, in a paper published during the current year. He reports 1 congenital and 2 traumatic cases, suggesting a method of closure to ensure against recurrence of the hernia. We may say, in passing, that we know from experience it is not always possible to successfully execute a previously planned procedure for permanent cure in these cases. This is also well illustrated by Downes's case of congenital hernia in a boy, about seven years of age, where it was impossible to restore the viscera to the abdominal cavity, necessitating, on account of the extreme condition of the child, a gastro-enterostomy to prevent starvation.

Downes believes from his experience that the abdominal ap-

proach is better, because in congenital cases in which hernia has occurred through a dilated opening it may be impossible to correct the condition by approach from above. In our own case, as the citation will show, it was impossible to successfully deal with the condition through the abdominal incision, necessitating a transthoracic operation.

Attention is called by the author last quoted to the possibility of mistaking a full stomach herniated through the diaphragm for pyopneumothorax, and states that several cases have been recorded in which such a mistake, followed by aspiration, terminated fatally. While in former years there may have been difficulty in diagnosis, we believe today, with the aid of the roentgenologist and stereoscopic views, the diagnosis can be accurately made in practically every case. In our own case no difficulties were presented after a stereoscopic picture was obtained.

When a large portion of the stomach is herniated the clinical history is similar to that of hour-glass or obstructed stomach, except that there are periods of remission and the symptoms begin in early childhood. However, the symptomatology, pathology and etiological factors have been so fully discussed in the literature that we will not consider them further in this paper, our desire being rather to report an interesting and probably unusual case, with the difficulties confronting us in our efforts at relief.

Case Report.—V. B., aged sixteen years, schoolboy, admitted February 2, 1919. The family history was negative. The boy had not been well since he was eighteen months old, at which time he had not yet been weaned. The mother noticed that he would frequently go the greater part of the day without nursing, and that often after nursing (during these periods) the ingestion of food was followed by vomiting. This was particularly true when he took much nourishment, overfilling the stomach, and was attributed to that cause. Later it was evident that the attacks of vomiting were induced by the recumbent posture. When the child was on his feet and going about he seemed to have less trouble. Vomiting was most fre-

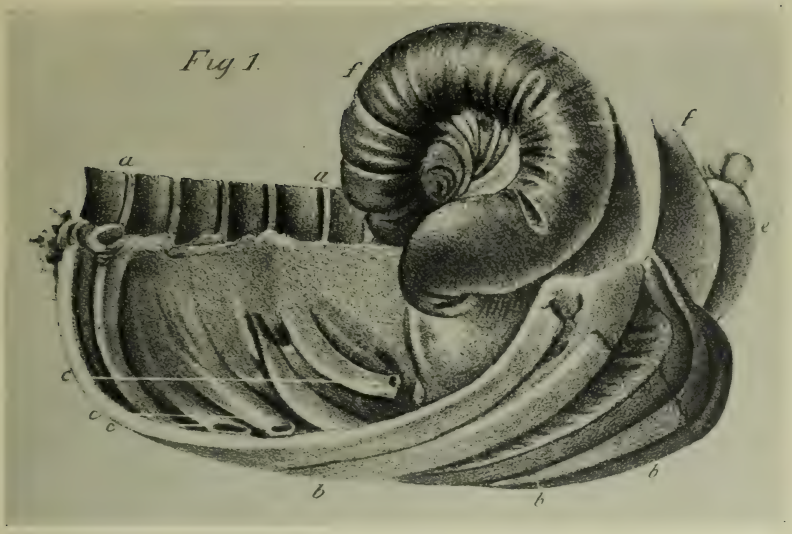

Fig. 1.—Phrenic hernia caused by fracture of the ribs. (From Cooper, "Hernia," 1804–1844.)

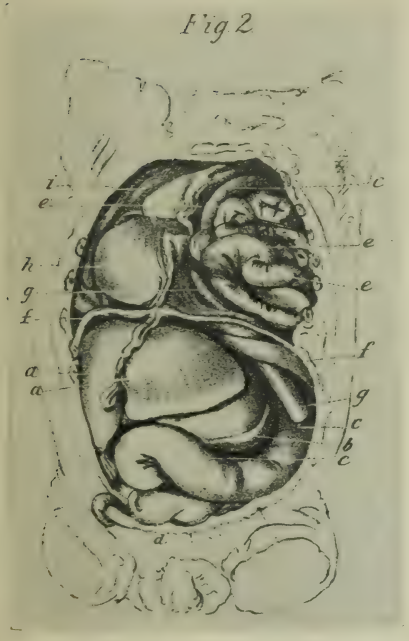

Fig. 2.—Phrenic hernia in the fetus. *g.g*, bougie passed through diaphragmatic aperture. (From Cooper, "Hernia," 1804–1844.)

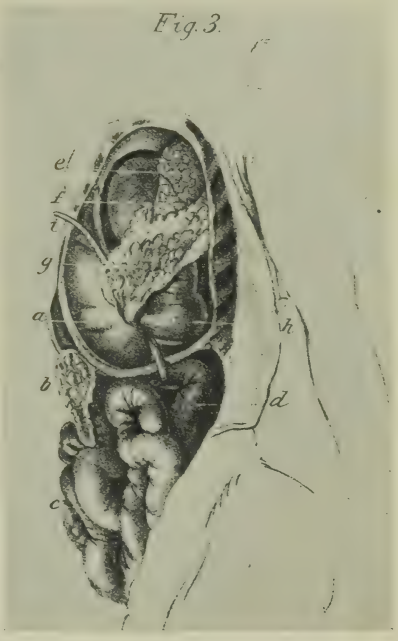

Fig. 3.—Strangulated phrenic hernia in adult. *i*, bougie under strangulated colon and omentum. (From Cooper, "Hernia," 1804–1844.)

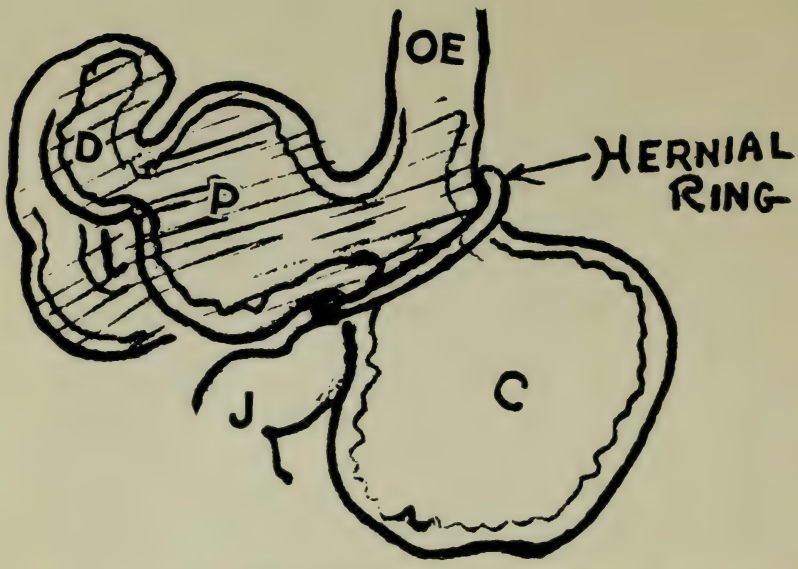

FIG. 4.—Diagrammatic drawing after abdominal exploration. Showing hernial ring with pylorus and duodenum within sac.

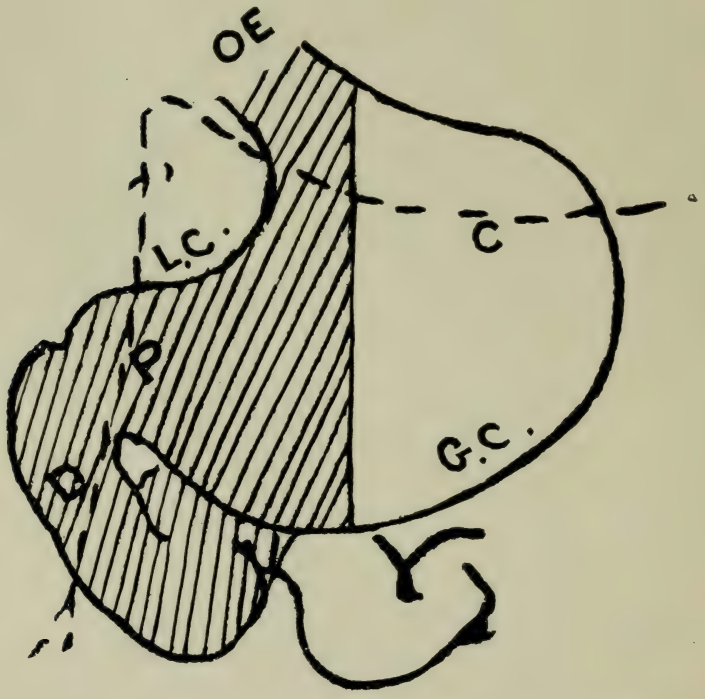

FIG. 5.—Diagrammatic drawing after reduction. Shaded portion formed hernial content.

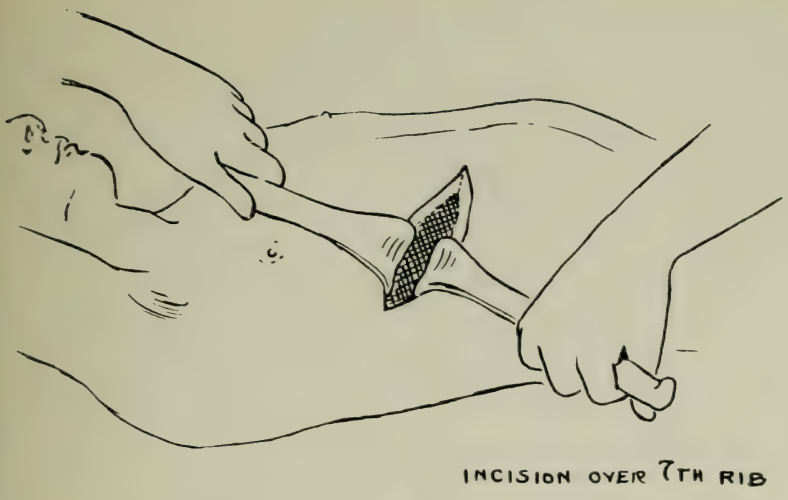
INCISION OVER 7TH RIB

FIG. 6

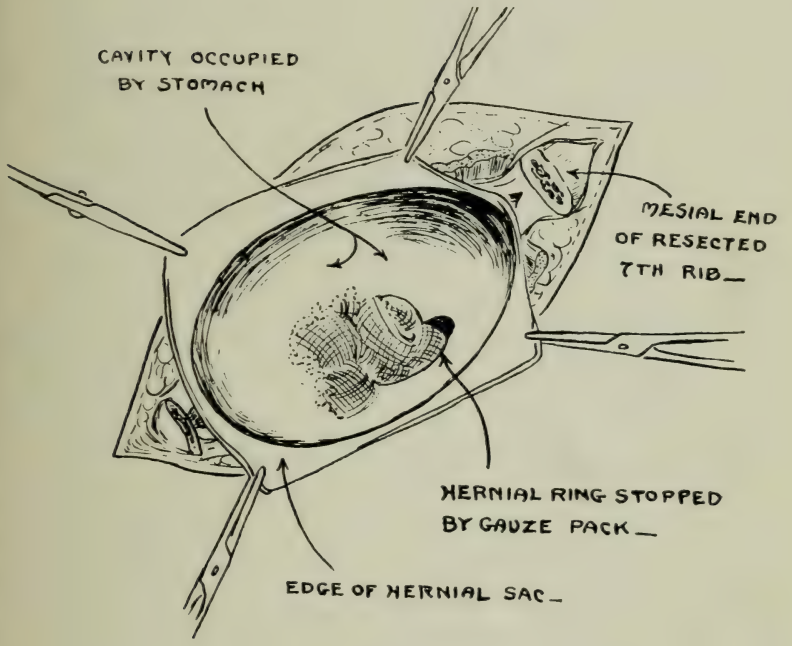
CAVITY OCCUPIED BY STOMACH
MESIAL END OF RESECTED 7TH RIB
HERNIAL RING STOPPED BY GAUZE PACK
EDGE OF HERNIAL SAC

FIG. 7

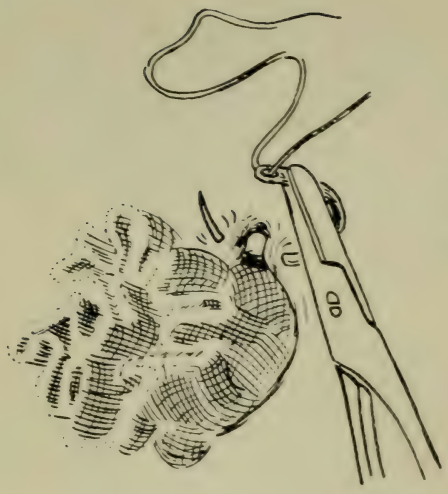

FIG. 8

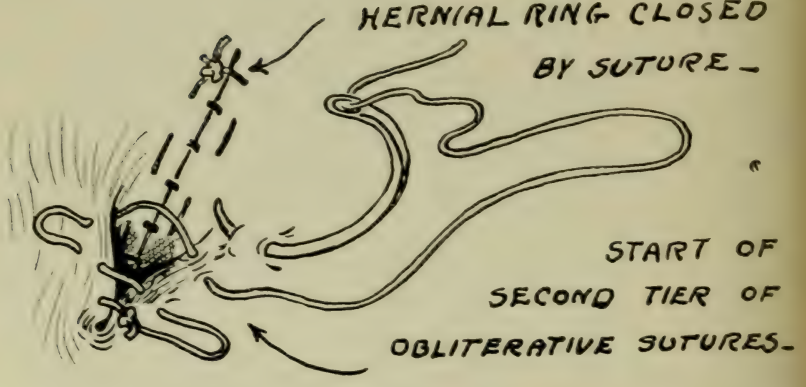

FIG. 9

FIGS. 6–9.—Various steps in the operation for closure of the hernia.

quent at night, and often the mother would remain up with him the greater part of the night on account of his apparent distress and his inability to retain food.

Vomiting was sometimes as frequent as six times daily, then again he would go for two weeks without an attack. For weeks at a time he would vomit food two or three times a week, and then he would be free of disturbance for a week or two. He did not gain rapidly in weight, though continuing to grow. What he gained in two or three weeks he would lose during the attacks. As a child he had almost constantly borborygmus without distention. This was often very annoying. The sounds were audible to those in the room, and were relieved to some extent by belching.

Later, as he took solid food, he would have little or no trouble for weeks at a time, when he would rapidly gain in flesh. For several years he had little trouble except occasional vomiting at night, accompanied by much abdominal pain. He was able to attend school, but could not indulge in much exercise for fear of an attack. He subsisted largely on liquid and soft diet taken in small quantities at quite frequent intervals. He never had any cardiac attacks nor respiratory difficulty.

Present illness and condition: The patient comes on account of marked gastric disturbance, which is irregular. He is having "attacks with his stomach" two or three times a week. During the attacks he has pain, "bloating of the stomach," and vomiting. He cannot eat without bringing on discomfort. This lasts a while, is followed by vomiting, the vomitus containing food eaten two or three meals previously, and after the stomach is apparently emptied he will again suddenly regurgitate or vomit more food. He can take only liquid and in small amounts, and even this at times induces vomiting of foul material. His trouble is made worse by the recumbent position. Epigastric discomfort is constant, but the vomiting itself is painless. The pain he has is not paroxysmal. There is no dyspnea nor does he have palpitation. He has seen many doctors, has been in bed much and has been roentgen-rayed several times. Four weeks ago he had a mild diarrhea, some clay-colored stools and was slightly jaundiced (?).

Physical Examination. A pale, anemic-looking, only fairly nourished boy. Skin: no jaundice, though skin rather sallow. Sclera: normal in color. Teeth and tonsils: normal. Head: negative. No enlarged glands nor evidence of glandular deficiency. Sexually: mature. Heart: negative from murmurs or increased size. Apex-beat: displaced upward but not laterally. No epigastric pulsations. Lungs: thorax full at lower part, not normal wedge shape. Normal breath sounds not heard in lower chest and seem altered over upper chest on right side; left side normal. Abdomen: negative for tumors, pulsations, rigidity and tenderness. Genitals: small right hydrocele, otherwise normal. Extremities: normal.

Analysis of the gastric contents was not made, though stomach lavage was followed shortly by regurgitation of a small quantity of foul-smelling fluid containing some undigested food particles. The urine was practically normal. The blood examination showed a decided diminution in red corpulses, normal number of whites, with hemoglobin, 70 per cent.

Our conclusions were that we had to deal with pyloric obstruction, *i.e.*, partial gastric obstruction. The patient was radiographed by Drs. Keith and Keith, of Louisville, whose report is appended:

January 11, 1919. Fluoroscopic Chest. The cardiac and aortic shadows are normal. The diaphragm is mobile, the dome being higher on the right side than normal. There is no loss of contour on either side.

Barium Meal. There was a delay of barium at the cardia with moderate dilatation of the lower end of the esophagus for about three inches. The cardia is high under the ribs on the left side, the shadow being about the size of a fetal head with no resemblance to the stomach shadow. After waiting a few minutes a small amount of barium was seen to the right of the spine, which gradually assumed a pear shape. This shadow was entirely under the costal cartilages and approximately on a line with the dome of the right side of the diaphragm. The shadow increased in size until about the size of a large orange, and pencil-shaped shadows could be seen con-

necting this mass with the mass under the ribs on the left side. Gas and fluid were seen around the shadow on the right side and by violent percussions in the epigastrium fluctuation was elicited.

A series of plates show a barium mass on the left side beneath the diaphragm the size of a small grape fruit. On the right side there is a much larger mass with areas of lessened density or gas shadows completely surrounding this mass. There is no evidence of barium passing from the shadow on the right side into the small intestine.

Three and one-half-hour meal. Approximately 25 per cent. of the barium had passed into the small intestine. No plates were made.

Six and one-half-hour meal. Approximately 25 per cent. of the meal remained in the stomach; 25 per cent. was in the terminal ileum. The cecum and transverse colon were partially filled, the head of the barium meal being at the descending colon.

Twenty-four-hour meal. Approximately 25 per cent. of the meal remained in the stomach. Head of the meal had progressed to the rectum, the sigmoid and descending colon being well filled. The splenic flexure was much higher than normal.

Thirty-hour meal. There was no change in the barium shadows.

Forty-eight-hour meal. Approximately 25 per cent. of the barium remained in the stomach, being entirely to the left of the median line (in the cardia). No barium was seen to the right of the median line but the fluid and gas shadows as described at first examination were easily visualized, and by vigorous palpation we could get movement in fluid and gas as fluid in chest when lung is collapsed.

Reëxamination January 31, 1919. Barium meal. The egress of barium from the esophagus was seen to appear first to the right of the median line. After the barium shadow was the size of a large grape fruit it rapidly fell below the diaphragm and to the left of the median line. Evidently at this examination the stomach was entirely in the right chest, and as soon as

moderately distended with barium solution the weight of the mass pulled the stomach into the abdomen, the cardia being visualized.

Plates made at this time gave the same type of shadows as at former examination.

Diagnosis. Hernia of the stomach into the right chest. The gas and fluid shadows we believe to be a sac for the hernia mass.

A study of stereoscopic plates made it at once clear that we had to deal with a large diaphragmatic hernia, the contents almost half filling the right chest cavity and consisting certainly of half of the stomach, namely, the pyloric end, with a large part of the duodenum.

On February 4, 1919, an exploratory celiotomy was performed, with the idea of ascertaining precisely what was the pathological condition, and if possible closing the opening by the abdominal route. When the abdomen was opened by median incision the round ligament was immediately indentified and the liver found pushed well to the right; the stomach with the duodenum, a large part of the omentum, and a small portion of the liver, were herniated into the right chest cavity through an opening which would easily admit four fingers. Reduction of the contents of the hernia into the abdominal cavity was attempted, and, while successful, was found to be most difficult on account of the negative chest pressure. When the viscera were released they were at once aspirated again into the hernial sac. The peritoneum was continuous into the sac, there being a distinct peritoneal covering of the hernial contents. Dr. D. Y. Keith was present at the operation, which was performed under nitrous oxide gas. The opening was so far posterior, in fact being an enlargement of the esophageal opening, that it was found impossible on account of its location—not only deep and high in the cavity but partially behind the liver—to effect closure. The abdomen was then closed in the usual manner.

On February 21 the second operation was done, the approach now being through the chest wall. Under nitrous oxide gas

five inches of the seventh rib were excised. On account of the compression of the lung some difficulty was encountered in free exposure of the hernial sac. The diaphragm was pushed upward and laterally and much thickened. Directly over the sac there was no covering except thickened connective tissue and peritoneum. No trouble was experienced from collapse of the lung, though no positive pressure was used with the nitrous oxide apparatus. We believe this was due to the collapsed condition of the lung on that side. Much trouble was encountered in replacing the contents of the hernia into the abdominal cavity, and even after this had been accomplished some difficulty was experienced in retaining the contents. The sac was not cut away, but was closed by deep through-and-through sutures extending from near the esophagus directly across the neck of the sac. These sutures extended into the abdomen and passed from the abdomen upon the opposite side outward into the sac again. After tying these sutures the sac was obliterated by suturing with catgut. The thoracic muscles and skin wound were closed in the usual manner.

Following the operation there was a rise in temperature to 102° F. and pulse to 120. These subsided to normal on the third day, following which there was no further disturbance. The patient was dismissed from the hospital on March 17, and a radiogram taken by Dr. Keith about eight weeks after his discharge showed the stomach in normal position.

Fluoroscopic Examination. There is no filling defect in the esophagus or stomach, and many contraction waves were present. The stomach was partially filled with food before ingestion of barium. The greater curvature is two inches below the umbilicus. Cap fills normally under pressure and is very flexible. There is no irregularity on either curvature of the stomach or in the cap. There is moderate dilatation of the stomach shadow. There is no evidence of any portion of the stomach above the diaphragm.

ADDITIONAL LITERATURE WITH CASE REPORTS SINCE SCUDDER'S PAPER IN ANNALS OF SURGERY, 1912, XV, 261

1914:		
Stuart McGuire:	South. Med. Jour., September	1 case
Ibid:	Virginia Med. S. M., December 25	1 "
1915:		
Moschcowitz:	Operative Therapeusis, Johnson	2 "
1916:		
Miller:	Am. Jour. Obst., February	1 "
Wood:	Surg., Gynec. and Obst., September	1 "
Field:	Jour. Med. Soc., New Jersey, May	1 "
Siebert:	Surg., Gynec. and Obst., October	1 "
Gordon:	British Med. Jour., August 19 (congenital)	1 "
Balfour:	Am. Surg., January	
Rayne-Jones:	Arch. Int. Med., February	1 "
Green:	Jour. Am. Med. Assn., July 15	1 "
Vitrac:	Jour. méd. Bordeaux, August	1 "
1917:		
Mitchell:	South. Med. Jour., July	1 "
Bevan:	Surg. Clinics, Chicago, June	1 "
McCleave:	Am. Jour. Dis. Children, March 2	1 "
Mercade:	Presse méd., March 22 (congenital)	1 "
1918:		
Martin-Du Pan:	Rev. Med. la Suisse, June	1 "
Montandon:	Ibid.	1 "
Schaldemose:	Hospitalstid., June 26	1 "
Hagen-Torn:	Russk. Vrach.	
Downes:	Surg., Gynec. and Obst., October (congenital)	1 "
Gross:	Jour. Med. Research, July	1 "
Dickie:	British Med. Jour., June 22	1 "
1919:		
Weidner:	Kentucky Med. Jour., Jan. 19, p. 42	1 "
McCandless:	Jour. Roent., March 19, p. 82	1 "
Soresi:	Ann. Surg., March 19, p. 254 (1 congenital)	3 "
Berard and Dunet:	Abs., Jour. Am. Med. Assn., April 19, p. 1193	1 "
Barton:	British Med. Jour., June 19, p. 767	1 "
Greig:	Edinburgh Med. Jour., June 19, p. 357	1 "
Warren:	Lancet, June 21, p. 1069	1 "
Lake and Keim:	Lancet, July 5, p. 13	1 "

1919:

Landelius:	Abs., Jour. Am. Med. Assn., July 12, p. 158 (congenital)	1 case
Ware:	Jour. Am. Med. Assn., July 26, p. 267	1 "
De Courcey:	Ann. Surg., August 19, p. 179	1 "
Bennett:	British Med. Jour., August 16, p. 203	1 "
Andrew:	British Med. Jour., September 27, p. 412	1 "
Graves (Louisville):	Society report, not published	1 "
Greiwe (Cinti):	Personal communication (congenital)	1 "

Cooper's work on Hernia (1804) cites 2 adult congenital cases.

DISCUSSION

Dr. Walter C. G. Kirschner, St. Louis, Missouri.—I have had occasion to see 3 cases of congenital diaphragmatic hernia, with prolapse of bowel into the pleural cavity that came to operation. Two of the cases made a satisfactory recovery. In my service at the City Hospital on another occasion my attention was called to a case of obstruction of the bowel, but upon further examination it was found the patient had what was called pneumothorax. The man refused operation, and in the meantime an *x*-ray study of the case showed a prolapse of the intestine into the pleural cavity. I mention this principally to emphasize the importance of the *x*-ray examination in clearing up the diagnosis in these cases.

We ought to differentiate congenital cases from the traumatic, and the cases of prolapse of the intestine from those of true hernia; meaning by cases of true hernia those in which there is a distinct sac. In emergency work we not infrequently encounter cases of prolapse of the intestine in which we have injury to the diaphragm, with the intestine, spleen, or stomach, going up into the pleural cavity and sometimes even through the external opening. I do not consider these to be cases of true hernia. In one of the emergency operations for abdominal hemorrhage, in the course of exploration, the omentum was missing, and it

was found that it had ascended through an opening in the diaphragm, and on exploring the pleural cavity I found there was a sac which contained this omentum. At the time of operation the man was pulseless, and it was impossible to do a complete operation aside from the control of hemorrhage which came from two vessels of the gastro-hepatic omentum. He rallied sufficiently to give us information of a stabbing affray that happened years before, and upon close examination I found there was a scar. At the autopsy the case was cleared up, a true hernial sac containing omentum being found. It is probable that in the first stabbing the diaphragm was injured, which left a weakened area, and the peritoneum becoming distended a true sac was formed into which the omentum had ascended, so that we had in this case a true diaphragmatic hernia.

The case also emphasizes the fact that in traumatic conditions, as well as in congenital conditions, these openings in the diaphragm should be closed the same as all abnormal openings to the abdominal cavity, so that hernias may be avoided. If we encounter these openings in the diaphragm they can be closed by the intra-abdominal route. By using a hook or a volsellum as a retractor and employing forcible traction, we can bring the wound into view and it may then readily be sutured.

SOME PLASTIC OPERATIONS ON THE RECTUM

By Harvey B. Stone, M.D.
Baltimore, Md.

This article is written to present, as briefly as possible, four operative procedures for the correction of rectal conditions of various types. Some of them have been published before, but are again described because they seem worthy of further notice.

1. In a certain number of cases following Whitehead operations for hemorrhoids the mucocutaneous margin, instead of being within the anal canal, is externalized; that is, a ring of everted mucosa extends around the anus. This probably results from the neglect of a precaution emphasized by Whitehead himself—the careful preservation of all skin so that the mucosa will not be pulled down and outside the sphincter in order to make the repair suture at the end of the operation. When such a condition exists there is a constant moisture about the anus, with erosion of the everted mucosa, pain and bleeding. To correct it the following plan has been successful: With the patient in the perineal position, two V-shaped incisions in the skin on each side of the anus are made. The angle of the V is placed about over each ischial tuberosity and one arm runs forward toward the center point of the perineum and the other back toward the tip of the coccyx. These incisions, however, are not carried across the midline either anterior or posterior to the anus, but end about one inch lateral to the midline on each side. The flap of skin enclosed between the V on each side is loosened up but not extensively undermined, and is pushed medianward toward the anal margin. The outer edges

of the V-incisions are then sutured to each other, converting the V into a Y and crowding the enclosed skin area toward the anus and holding it there. The faulty mucocutaneous margin is then divided by a circular incision, the mucosa dissected upward into the anal canal until a cuff of it is freed all around and this cuff then amputated. The mobilized skin edge is then sutured to this shortened mucosa, pulling it well up into the anal canal. In short this part of the operation is simply a repetition of the original Whitehead, with a mobilized and sufficient skin margin to repair the fault of the first operation.

2. In certain special types of stricture of the rectum an application of the principle of the Heineke-Mickulicz pyloroplasty is helpful. These strictures are of the diaphragm type; that is, firm, with small lumen, but narrow and annular in their involvement of the long axis of the bowel. The stricture is incised in the posterior midline down to its base, and the superior and inferior edges of the incision are sutured to each other, so that the line of repair runs transverse to the long axis of the bowel. After having employed this measure several times I found that it had already been described by Dr. Arthur Dean Bevan in *Chicago Clinics,* 1917.

3. In tubular strictures of the rectum, occurring in the lower four inches of the bowel in multiparous women, the utilization of part of the voluminous vaginal mucosa as a transplant into the rectum has been tried. This has only been done when long-continued dilatations have failed to give relief and where the Wassermann test has been for a long time negative. The posterior vaginal wall is incised longitudinally in the midline, exposing the strictured rectum from in front. Some of the scar tissue about the rectum is dissected away and then it is incised longitudinally in the anterior midline. The edges of the vaginal incision are sutured to the corresponding edges of the rectal mucosa, thus forming a rectovaginal fistula; then on each side of this fistula a flap of vaginal mucosa, about an inch wide, is outlined and its outer edge dissected up, leaving the inner portion about the rectovesical fistula still attached. The freed outer edges of these two flaps are turned

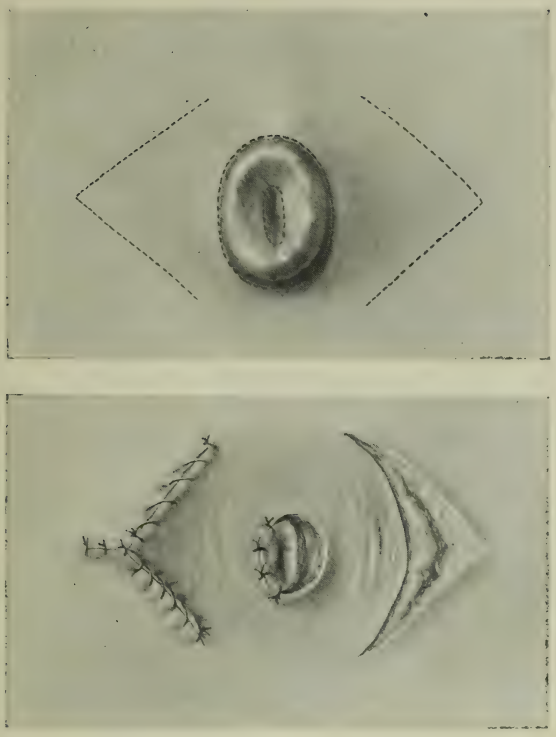

FIG. 1.—Incisions and sutures for repair of faulty Whitehead operation with everted mucous membranes.

FIG. 2.—A sagittal section showing type of stricture in which vaginal mucosa may be utilized.

Fig. 3.—Incision in midline of posterior vaginal wall.

Fig. 4.—Incision carried through anterior wall of rectum, dividing stricture.

FIG. 5.—Suture of rectal and vaginal margins and outline of vaginal flap.

FIG. 6.—Freeing of edges of vaginal flap.

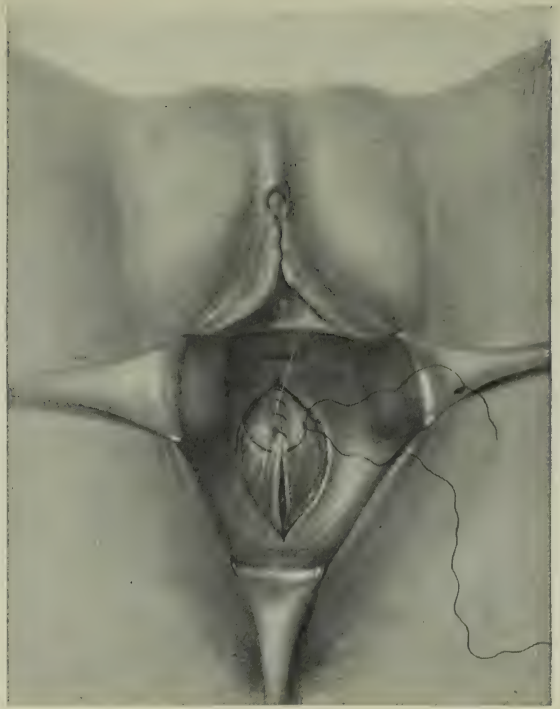

Fig. 7.—Outer edges of vaginal flap sutured together across the midline.

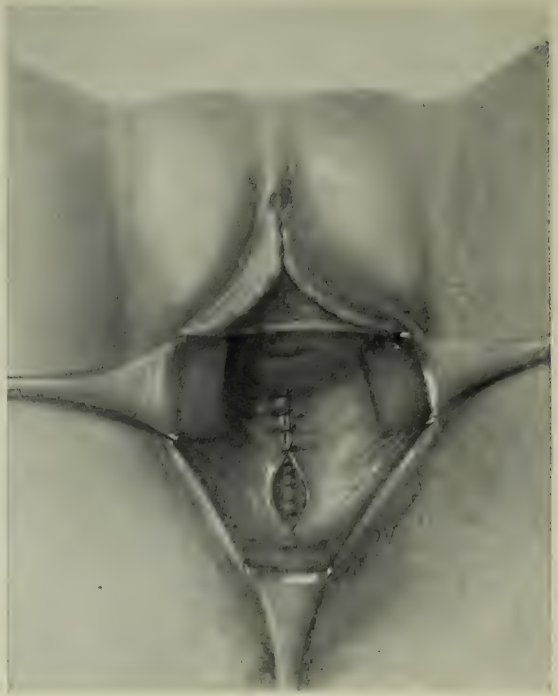

Fig. 8.—Repair of posterior vaginal wall.

over toward each other and sutured together in the midline, thus causing the flaps to fold over and face downward toward the rectum. The remaining vaginal mucosa is then brought together over these reversed flaps, burying them in the rectum and the posterior vaginal wall is repaired. This procedure implants two-inch wide strips of mucosa in the rectum and widens the stricture very materially.

4. With the collaboration of Dr. Hugh H. Young an operation has been devised for the correction of rectourethral fistula in the male. Case reports with details of a number of such operations have been published elsewhere. In this paper only an outline of the method will be given. The first step is the establishment of urinary drainage by a suprapubic cystostomy. Then a midline incision in the perineum, begun at the midpoint of the perineum, is carried backward to the anterior anal margin and then about the anus at the mucocutaneous junction. The bowel is then dissected upward as in a Whitehead operation and the sphincter divided in the midline anteriorly. The incision permits the exposure of the deep urethra through the perineum and the mobilization of the rectum, which is dissected loose all around to a point well above the entrance into the bowel of the fistula. This dissection, of course, divides the fistula. The urethral orifice of the fistula is now closed by sutures placed over a sound. The bowel is brought down until the rectal orifice of the fistula is drawn outside the skin level and fixed in this position by stay sutures. The perineum is reconstructed by drawing the muscles together and the sphincter is repaired. The distal extremity of bowel bearing the fistula is amputated, and the stump of proximal bowel sutured to the anal skin as in Whitehead repair. The perineal incision is also closed. The advantages of this operation are direct closure of the urethral orifice, the complete removal of the fistulous area of the rectum, the interposition of the perineal structures between the rectum and the urethra and the temporary diversion of the urine. It has proved very successful in practice.

DISCUSSION

Dr. George A. Hendon, Louisville, Kentucky.—I was deeply interested in the report of Dr. Stone on account of some recent personal experiences in a case in that connection. In the case I had, I thought the opening in the rectum was entirely too high to admit of amputation. This man had been operated on forty years ago, and in the performance of this operation an incision was made in the rectum which never healed, and established a communication between the rectum and bladder that persisted for a period of these forty years. A year and a half ago he applied to me for treatment on account of pain and frequent micturition, and upon examination I discovered the presence of a very large stone. This stone I removed through the rectum, delivering it pretty much after the manner of an obstetrical operation, using a lithotomy forceps for that purpose. After he was cleaned up and washed out he got much better, but the infection of his bladder reëstablished a cystitis, then he returned for treatment. In dealing with this case on this occasion we made an incision similar to the one that is used by Dr. Young in the performance of his prostatectomy operation, a V-shaped incision, and dissected up through the perineum, except we separated the rectum from the adhesions to the bladder. We did not make any attempt to close the opening in the bladder, and introduced a mushroom catheter and allowed it to remain. We did make a closure of the opening in the rectum and carried a colon tube a considerable distance above the site of the rectal fistula. The case did very well, and the catheter we placed for drainage inside the bladder we removed after about two weeks. He made a good recovery, with the exception of a perineal fistula that discharged urine, and this has been successfully taken care of by my colleague, Dr. Windell. I feel we are going to get a successful operation.

Dr. Thomas S. Cullen, Baltimore, Md.—In our rectovaginal fistulæ we have for over ten years been using a method somewhat analogous to the one Dr. Stone has described. A longitudinal incision is made through the vaginal mucosa of the pelvic floor and the mucosa dissected free from the rectum over a consider-

able area. An incision has then been made at the mucocutaneous margin of the anus and the rectal mucosa gradually dissected free and drawn down until the fistulous hole in the rectum is outside. The excess of bowel mucosa together with the rectal fistula is then cut off just as would be the case in an extreme Whitehead for prolapsus. The rectal mucosa is then attached to the skin of the anal margin and the vaginal walls sutured. With this method we have had good results, but in some cases we did not sufficiently mobilize the bowel. In such cases the mucosa after a few days would slip up and a new small recto-vaginal fistula would form just above the external sphincter.

FURTHER OBSERVATIONS ON THE FUNCTION OF THE CORPUS LUTEUM

By Edward H. Ochsner, M.D.
Chicago, Ill.

According to our present conception the ovary is a complex glandular organ, with at least two quite distinct functions. First, the production of ripe ova, and second, the elaboration of one or more internal secretions. While neither of these functions is absolutely necessary to the life of the individual, the former is positively and the latter probably absolutely necessary to the propagation of the species and the latter very essential to the well-being and comfort of the individual. Up to the time of the advent of abdominal surgery, few if any suspected that the ovaries had any function other than the production of ova, and if one is to judge by the reckless sacrifice of these organs, most men utterly disregarded their second function even for a considerable number of years after gynecological surgery became generally practised. When the number of nervous wrecks due to this practice became too numerous for the comfort of the operators they began to take heed. The practice of removing both ovaries except when absolutely necessary was discontinued some twenty to twenty-five years ago, and since that time also numerous studies have been undertaken to determine the exact function of these organs, and while much has been learned, much is still to be learned.

Several years ago some very interesting data collected by a number of veterinarians came to my attention. These data have

in part been checked up by me on the human female, and both are here presented, with the hope that they may shed some additional light on the role played by the ovaries. I here confine my observations very largely to the function of the corpus luteum and the influence it seems to have on pregnancy, sterility, abortion and intra-abdominal hemorrhage simulating extra-uterine pregnancy.

Veterinarians have observed that if a false corpus luteum remains unabsorbed in either ovary of a cow she does not come in heat, and so long as she does not come in heat she, of course, does not conceive. On the other hand, as soon as this false corpus luteum is absorbed normally or expressed manually by the operating hand of the veterinarian, the phenomenon known as heat invariably develops within forty-eight to one hundred and twenty hours, and with suitable environment impregnation occurs. This observation has been made so many times by a sufficient number of highly trained, observing, experienced veterinarians that, in the minds of these men, this is no longer a debatable question.

Under normal condition when there is no opportunity for impregnation the period of heat in the cow recurs every twenty-one days and the false corpus luteum is absorbed in about three weeks. This last statement is based on the observations of veterinarians, who ordinarily find the ovary, from which the last ripe ovum has escaped, to assume about the normal size at the end of two weeks, so that by the time the next cycle begins the false corpus luteum has become entirely absorbed. Under abnormal pelvic conditions in the cow the absorption of the false corpus luteum may be delayed for weeks and even months. The abnormal conditions which seem to prevent the absorption of the corpus luteum are usually pelvic abscesses, salpingitis and endometritis, due to an infection caused by the bacillus of Bang. That this is a fact is evidenced by the following: cows suffering from these pathological conditions due to this infection often do not come in heat for months, and in such cases an examination practically always discloses an unabsorbed corpus luteum in one of the ovaries. If this corpus luteum is manu-

ally expressed the cow invariably comes in heat within forty-eight to one hundred twenty hours, the first requisite to possible impregnation. The possibility of impregnation now, however, depends upon the severity of the pathological changes and the acuteness of the infection. If the infection has been relieved, impregnation will now take place in the large majority of these cows.

Dr. R. N. Gordon Darby, formerly of Barrington, Illinois, and now of Hackettstown, New Jersey, several years ago took charge of a herd of one hundred high-grade Holstein cows, the average value of which was about $400 per head. The year before he took charge of this herd only fourteen viable calves were produced on this farm. Most of the cows were sterile, a large percentage of them did not come in heat at all and the others did not conceive, some of them having been bred more than a dozen times without resulting pregnancy. Nearly all of them were infected with the bacillus of Bang, and those that did not come in heat had unabsorbed corpora lutea. After the pelvic infection and endometritis had been relieved by irrigating the uterus and vagina with large quantities of Lugol's solution, those that did not come in heat quite readily conceived, as did also those with unabsorbed false corpora lutea immediately after the corpora lutea had been expressed. The first year following this line of treatment the number of calves produced on this farm had risen considerably, and the second year, when the benefits of this dual treatment became fully effective, the number of viable calves this herd produced was eighty-six.

Pelvic infections have long been recognized as the cause of sterility in the human female, and every operating surgeon with large experience could report many cases in which the relief of pelvic infection has made conception possible. I have had a considerable number of patients, with premature menopause, who gave the history of having suddenly stopped menstruating because of a severe chilling during the menstrual period and who have never menstruated since, and another considerable number of patients who, following a chilling or a severe illness during a menstrual period, menstruated only at

intervals varying from several months to several years, who suffered from the distressing symptoms of artificial menopause. In view of the above experience on the cow I would today laparotomize such patients, carefully examine the ovaries, and if an unabsorbed corpus luteum were found, excise the same with the hope of relieving the symptoms, reëstablishing menstruation and curing the sterility.

The following case is presented as possibly belonging to this class: *Case I.*—Miss A. N., aged twenty years. Present illness began about six weeks ago, with severe pain in the right lower quadrant of the abdomen and pyrexia. Menstruation regular twenty-eight-day type, but has not menstruated during the past ten weeks. A tender mass the size of a large orange to the right of the uterus. Uterus fixed. Median laparatomy: appendix, cecum, omentum, loop of small intestine and right tube all involved in a mass around an abscess of the right ovary about the size of a lemon. Adhesions loosened; appendectomy. Right oöphorosalpingectomy. Left tube thickened; size of the little finger; excised. Left ovary, containing false corpus luteum, resected. Patient started to menstruate thirty-six hours after operation. Just why this patient missed two menstrual periods and then began to menstruate thirty-six hours after the operation I am unable to say, but I believe her case belongs in this general category.

That expression of a retained false corpus luteum will bring on heat in the cow has been demonstrated by veterinarians in literally hundreds of instances. So far as I am able to determine from the literature the observation that injury, expression or excision of a false corpus luteum will bring on menstruation in the human female has not been made or at least not emphasized. Rubin[1] in his paper, while he speaks of the inhibitory effects of menstruation of ovarian cysts and gives detailed histories of rupture of a false corpus luteum, does not state specifically whether such rupture brought on menstruation or not.

[1] Surg., Gynec. and Obst., April, 1917, pp. 443–453.

Just what relation to the whole sex-cycle menstruation bears I have not been able to determine definitely either from my readings or from my own clinical experience. But that menstruation in the human female bears a close relation to heat in the cow is evidenced from the fact that expression of a false corpus luteum from the ovary of a cow will cause heat within forty-eight to one hundred and twenty hours in every instance, while expression or excision of the false corpus luteum in the human female causes menstruation in from twelve to thirty-six hours in every case. Just why menstruation should occur more quickly in women than heat in the cow when the false corpus luteum has been expressed is not clear. Theoretically one would expect estrus to precede menstruation and menstruation to be the terminal stage of the sex-cycle in those cases in which the ovum has not been impregnated. In support of the statement that menstruation invariably occurs within twelve to thirty-six hours after the expression of false corpus luteum in the human female, permit me to report very briefly the essential points in the following nine histories. I have a number of other similar cases, but I believe these will suffice to establish this point.

Case II.—Jessie S., aged twenty years. Low median incision; appendix somewhat inflamed and congested. Both tubes tortuous; thickened to the size of an index finger, closed at distal ends. Left tube adherent to the surrounding ovary, with which it makes a mass the size of a small lemon. Both tubes and left ovary removed. The left ovary contains a false corpus luteum. Last menstrual period began seventeen days before operation and persisted for two weeks, so that she had been clean only three days. Twenty-eight-day type. Patient began to menstruate thirty-six hours after operation and eleven days ahead of time.

Case III.—Mrs. J. A., aged forty-five years. Double salpingitis with the left ovary and tube adherent to the sacrum. Double salpingectomy; a portion of the left ovary contained a false corpus luteum; resected. Menstruation irregular, but never too frequent before operation. Began to menstruate

twenty-four hours after resection of ovary, though she had been over her last menstrual period only one week.

Case IV.—Mrs. A. L., aged thirty-five years. Low median laparotomy; loosening of adhesions of the mesocolon to the former appendix scar. Removal of two filbert-sized fibroids from the uterus. Removal of both inflamed tortuous tubes and resection of adherent left ovary containing a false corpus luteum. Began to menstruate thirty hours after operation, though previous menstruation had started twelve days before operation and ended eight days before operation. Her usual menstrual flow lasted three or four days of the twenty-six-day type, and was very regular.

Case V.—Mrs. S. R., aged thirty-nine years. Low median incision; appendix inflamed, thickened. Appendectomy. Uterus and both adnexa in a mass in the cul-de-sac. Right ovary and both tubes removed. In loosening adhesions about the left ovary the corpus luteum in the same was injured. The patient began to menstruate in thirty hours, though her previous menstruation has stopped only three days before operation. Regular twenty-eight-day type.

Case VI.—Mrs. F. H., aged twenty-six years. Low median incision; appendix inflamed and adherent. Patient just over an acute appendicitis; appendectomy. Left ovary adherent and loosened. In doing so injured the false corpus luteum. Began to menstruate thirty-six hours after operation.

Case VII.—Mrs. G. E., aged thirty-six years. For a number of months has complained of severe pain in the left lower quadrant about one week after the menstrual period. Menstruations regular of the twenty-eight-day type. One week after the second last menstruation was examined and the left tube found considerably enlarged. Present condition, one week after the last menstruation, the mass to the left of the uterus was about the size of a lemon, painful and tender. Low median laparotomy; appendix embedded in adhesions removed. Left tube and ovary make a mass about the size of a small lemon, firmly adherent to the cul-de-sac. Adhesions loosened; left ovary and tube removed. Patient menstruated thirty hours after operation.

Case VIII.—Mrs. M. S., aged twenty-three years. Menstruation at seventeen, then no period for about a year. Then menstruated almost continuously for two years, when she had a laparotomy; removal of left ovary; tumor of uterus and appendix. Well for about two years, then had a sudden profuse vaginal discharge, which has kept up ever since. Had another laparatomy six months ago, when she was informed there was an abscess of the ovary and the uterus was fastened. No relief since, but constant pain in the right side and back, occasional sick headaches. One abortion three years ago; no other pregnancies. Tongue clean; heart and lungs normal; perineum intact; cervix normal; uterus in normal position and freely movable; to the right of the uterus was a fluctuating mass about the size of a small orange. Median incision through former scars. Adhesions of omentum to former abdominal incisions loosened; tears and omentum repaired. Fluctuating tumor about the size of a small orange to the right of the uterus and adherent to it. Apparently a degenerated cystic ovary; removed without rupturing it. Both tubes and the left ovary removed at former operations, as was also the appendix. Adhesions of appendices epiploicæ loosened and ligated. Wound closed. Patient of twenty-eight-day type; regular; last menstruation began ten days before operation; flow continued for three days; began to menstruate again twelve hours after operation. Has not menstruated since; operation was performed on October 1. Examination December 1, result was apparently perfect; patient stated that she had not felt so well in years.

Case IX.—Mrs. A. J. was sent to the hospital by her family physician on November 8, with diagnosis of acute perforated appendix. On bimanual examination a fluctuating mass was found to the right of the uterus and in the lower quadrant of the abdomen; irregular; lobulated; tense; size of a large orange. Moderate pyrexia; nausea; severe pain. Three days later low median incision; fluctuating lobular tumor of the right tube and ovary; each about the size of a lemon. Left ovary and appendix had been excised at a previous operation.

Uterus adherent far down in the pelvis; adhesions loosened; right tube and ovary removed without rupturing. Temporary ventrosuspension of the uterus. Patient regular of the twenty-eight-day type; her last menstruation had begun fifteen days before the operation and ended nine days before the operation. Began to menstruate thirty hours after the operation. Left the hospital on the eighteenth day. Wound completely healed; pelvis negative; general condition excellent.

Just why these two last women should have a typical menstrual flow after the removal of their last remaining ovary can, it seems to me, be explained only on the supposition that in each instance the remaining ovary contained a false corpus luteum and that its removal brought on the menstrual period.

Ordinarily the true corpus luteum is retained in the ovary of the cow from thirty to seventy days after parturition. This statement is based upon the following facts: First, usually the cow does not come in heat for this period after calving; second, the true corpus luteum can be felt by the operating veterinarian on examination for approximately this length of time; and, finally, when this true corpus luteum is expressed the cow will invariably come in heat within forty-eight to one hundred and twenty hours. This fact is made use of by veterinarians to get valuable cows to produce a larger number of calves. In this way a valuable cow can be made to produce a calf every forty-two to forty-four weeks instead of every fifty-two weeks, an increase of fecundity of about 20 per cent., which in a cow whose offsprings vary in value from $10,000 to $100,000 is quite an item.

The absorption of the true corpus luteum is delayed in the presence of lactation. Every bright country lad knows that cows that are suckling their calves do not come in heat as quickly as those which are milked and that some cows, as well as mares, will not breed at all while running with their young. This observation is corroborative of the common belief among women that nursing prevents pregnancy in a considerable portion of cases.

Veterinary surgeons have also made another very important

discovery. Sometimes in expressing what they consider a false corpus luteum they have actually expressed or ruptured a true corpus luteum, in which instance one of two things has invariably happened—either the cow has bled to death in a very short time or she has aborted within twenty-four to thirty-six hours. This observation on the cow throws very interesting light on the problem of abortion. This experience by veterinary surgeons, as well as my own experience in operating on pregnant women, leads me to believe that abortions following abdominal traumas are caused by injuries to the true corpus luteum and not to traumatism of the uterus itself, and that in operating upon a pregnant woman the important precaution is to avoid traumatism of the ovary containing the true corpus luteum if one wishes to avoid interruption of pregnancy. I have operated on a goodly number of pregnant women in almost every stage of pregnancy for a variety of abdominal conditions, such as intestinal obstructions, hernia, appendicitis, gall-stones and even fibroids of the uterus, and with the exception of Case No. XI, herein reported, never caused an abortion. I believe this has been possible because I have always been very gentle with the ovaries at the time of such operation, not because I have known the fact that injury of the true corpus luteum would produce abortion, but because I have made it an invariable rule to treat all intra-abdominal organs with the greatest care and consideration.

The following history is a fair illustration of this class of cases:

Case X.—Mrs. E. A., aged twenty-five years. Chronic intestinal obstruction, with acute exacerbation. Low median incision, omentum slightly adherent to old laparotomy scar. A thin band extending from one loop of small intestine across another loop to the stump of the left broad ligament making partial obstruction of the bowel. Band ligated double and severed. Uterus the size and shape of a large Bartlett pear, softish and in normal position. Right ovary contains true corpus luteum. Uterus and ovary handled with the greatest gentleness. Patient's last menstruation was sixty days ago.

Wound closed, patient made an uneventful recovery, no uterine contraction or abortion. Six months later the patient was in good condition; pregnancy progressing normally and expects to be delivered in about two months.

The tolerance of the pregnant uterus to traumatism was indelibly impressed upon me some years ago. A woman three months pregnant, with multiple uterine fibroids, one on the posterior surface of the uterus at the junction of the body and neck, insisted upon having an operation. She had lost two former pregnancies, one at the fourth month from abortion and the other at the time of birth from craniotomy, because the largest fibroid on the posterior surface of the uterus had made normal delivery impossible. She was very anxious to be the mother of a living child, and argued that having failed twice she was willing to take almost any risk to save this pregnancy. The small fibroids on the fundus of the uterus were easily removed, but the one of the posterior surface offered great technical difficulty and necessitated considerable traumatism. The patient, however, made an uneventful recovery, and never having any labor pains nor any uterine bleeding, went on to full term and gave birth to a living child. I firmly believe now that if I had injured the true corpus luteum this fortunate outcome would not have occurred and the resultant abortion would probably have been ascribed to excessive traumatism of the uterus.

The importance of avoiding injury or excision of the true corpus luteum in case of pregnancy is further emphasized by the following two histories:

On April 4, 1919, I made a preliminary report on this subject before the Chicago Surgical Society. Shortly after I met a colleague, who, after greeting me, accosted me in the following words: "Your observations on the function of the corpus luteum explain to me now why Mrs. X aborted," and then gave me the following history: "About six years ago I operated on Mrs. X for an acute appendix. She was three months pregnant and I took particular pains not to manipulate, traumatize or even touch the uterus, but finding what looked to

me as an enlarged cystic right ovary I excised it. The woman aborted in forty-eight hours."

Case XI.—On April 8, 1919, Mrs. J., aged twenty years, came to me for examination, from whose history I take the following essential points: One child one year ago; no miscarriages. Never strong since birth of child; has pain in the left side; appetite poor; quite nervous; bowels constipated; nursed baby up to a few days ago. Considerably emaciated. Present weight ninety-eight pounds; one year ago weighed one hundred and forty pounds. Tongue thickly coated; perineum somewhat relaxed; uterus in normal position and fairly movable; cervix normal; right adnexa normal; left ovary and tube distinctly enlarged and tender. Laparotomy advised, but the patient did not come to the hospital until June 11, or nine weeks after the first examination. Examination at this time showed no change. Patient was laparotomized the following morning. Appendix was found slightly adherent and constricted and was removed. Left tube enlarged and inflamed; distinct varicocele of left broad ligament; enlarged left ovary containing either a true or a false corpus luteum. Left oöphorosalpingectomy. Thirty-six hours after the operation the patient aborted, and on careful inquiry it was discovered that she had menstruated only once since the birth of the last child, namely, on May 8, and had missed her menstruation on June 5.

This experience emphasizes two things, namely, that the excision of the true corpus luteum causes abortion, and that if a considerable interval intervenes between the first history taking and the operation the first history should be carefully brought down to date, particularly if the patient is a female of the child-bearing age.

In recent years a number of articles have appeared in the medical journals emphasizing the fact that in many cases of supposed extra-uterine pregnancy neither the fetus nor the placental tissue can be found on the most careful search. My own experience has been along the lines of these articles. In two such cases in which I made a preoperation diagnosis of

extra-uterine pregnancy I was unable to find anything wrong with either of the tubes in spite of the fact that there was a moderate amount of free blood in the pelvis. I believe now that if I had examined the ovaries more critically I would have found a ruptured false corpus luteum in each case. A number of such observations have actually been made by other operators, and I believe ruptured false corpora lutea with pelvic hemorrhage and irregular menstruation are much more common and true ruptured extra-uterine pregnancy less common than heretofore supposed.

The observations of veterinarians on the cow are corroborative in certain respects of the work done by Fraenkel[1] on the rabbit, but much more convincing, as shedding light on the same problem in the human female; because made on a much larger number of cases and on an animal species that has, as a rule, single instead of multiple fetations and a period of gestation almost identical with that of the human species.

I believe the above data justify, tentatively at least, the following conclusions:

First, an unabsorbed false corpus luteum prevents ovulation and is a common cause of sterility and that the expression or excision of such a false corpus luteum invariably brings on menstruation.

Second, that the excision or rupture of a true corpus luteum invariably results in interruption of pregnancy, at least during the early months of pregnancy, and that it may be looked upon as a common cause of abortion.

Third, that an injury to either the true or false corpus luteum may simulate ruptured extra-uterine pregnancy.

DISCUSSION

Dr. Thomas S. Cullen, Baltimore, Maryland.—I was much interested in Dr. Ochsner's paper. I would like to ask him to

[1] Liepmann's Handbuch der Frauenheilkunde, 1914, vol. iii.

define the difference between true and false corpus luteum. Further, I would like to ask him what the inflammation is like in the cow, if an abdominal examination was made, or if the patient should die? I would like to ask him how the corpus luteum is expressed in the cow?

Dr. J. Wesley Bovée, Washington, D. C.—I have seen a great deal in the literature, and I hear it again in this paper of Dr. Ochsner's, that the removal of the corpus luteum in the early months of pregnancy will induce interruption of the pregnancy, but my own personal experience is exactly the opposite. In 3 cases in which I removed the corpus luteum in the early months of pregnancy, not one aborted. I was deeply interested in 1 case and reported it several years ago. The woman going to full term was delivered in the obstetrical service of the late Dr. A. F. A. King. This woman was in her second month of pregnancy when I removed both appendages for double pus tubes, with a hopeless condition of both ovaries. In looking up the literature and hearing discussions on this subject, either my cases were unique or something was wrong in some place in the observations.

Dr. Ochsner.—Removal of the corpus luteum will invariably produce that result.

Dr. Bovée (resuming).—In my 3 cases it did not produce that result. I would say also, in some of these cases in which there are clinical manifestations of ruptured tubal pregnancy, it is not necessarily hemorrhage from the corpus luteum, but from the ovary. Whether it comes from the corpus luteum or some other portion of the ovary, it is an ovarian hemorrhage resulting in hematocele. These cases are not uncommon. You will find many times in these ovaries several areas of hematomata, indicating stromal or follicular ovarian hemorrhage, giving the symptomatology of absence of one or two periods of menstruation like ectopics. These histories also include an absence of menstruation and a previous infection. English writers particularly have described this.

Dr. William T. Black, Memphis, Tennessee.—I would like to ask Dr. Ochsner if he thinks it is necessary for the corpus

luteum of pregnancy to govern the pregnancy; and how early will the hormone from the placenta take up its function and preserve the fetus?

Dr. Ochsner (closing the discussion).—In answer to the first question of Dr. Cullen, I would say that I considered seriously whether I should use only the term corpus luteum or whether I should use the terms true and false corpus luteum, for I am well aware of the fact that our best authorities say that you cannot tell the difference between the two on microscopical examination. However, I deliberately used both terms in my paper because I felt it would help to make the matter more clear and because the affect on the patient differs when a corpus luteum is expressed whether the patient is pregnant or not.

Regarding Dr. Cullen's second question, I would say that the veterinarians examining these animals are not so much concerned with the question as to whether the cow will live or die, but whether the cow is going to be a valuable asset on the farm or not. The veterinarian will carefully examine such a cow and if he finds that the pelvic infection cannot be relieved within a reasonable time the cow is killed, a postmortem examination is made and the diagnosis checked up. In many of these cases huge abscesses have been found corresponding pathologically to similar conditions in the human female. These men make a business of diagnosing the condition and giving a prognosis, then if it seems likely that the cow can be made to conceive within a reasonable time they institute the necessary treatment. These observations have now been made on literally thousands of cows and the cow is a much better animal to work on than the rabbit, because she as a rule has single fetations instead of multiple fetations. She has practically the same period of gestation as the human female, so that observations on the cow are very much more convincing to my mind than the work of Fraenkel on the rabbit, which is reported in my paper, but which I did not read on account of the time limit.

A WARNING AGAINST PROMISCUOUS UTERINE CURETTAGE

By J. Wesley Bovée, M.D.
Washington, D. C.

Of all gynecological operations performed probably the most frequent is curettage of the body of the uterus. The invention of the uterine sound by James Y. Simpson caused exploration of the uterus with it to be a very popular procedure. One can be thoroughly convinced of that by merely consulting the *Index Catalogue of the Library of the Surgeon General's Office*. There will be found an overwhelming number of titles on the subject, and one reading even a small number of the papers there listed under the proper heading cannot but be impressed with the pervading enthusiasm. Jennison's sound, brought forward some years later, also became a favorite instrument. Its use was largely in the reposition of retroverted uteri. I plead guilty to "triumphantly" using this instrument in 1886 and 1887, and the pain thus induced, when adnexal adhesions unknowingly existed, is well remembered. Possibly damaging infection may have been produced by my nefarious efforts.

The uterine curette, introduced to an embryonic state of development of gynecology, as it was, rapidly attained a high degree of popularity that has continued with but slight lessening of late. That the most slovenly and ignorant physician resorts unhesitatingly to the curette for various diseases of the uterus, real or otherwise, and, even of the appendages, is a notorious fact. It is equally true that curettage in the office

of a physician with a very lax degree of surgical cleanliness is commonly done.

That curettage has a field in gynecological procedure is not to be doubted, but the ring of limitation around it is constantly narrowing. The narrowing is not comprehended by the vast majority of our profession, and to those its practice is far too simple to appear dangerous, and besides, it tends to easy progress toward being known as surgeons.

INDICATIONS. The principal reasons for curetting the body of the uterus are to secure material for diagnostic purposes; to remove mucous polypi; in the treatment of exfoliative endometritis; of calcareous areas formed by calcified submucous fibroids and some rare cases of senile endometritis, especially following senile pyometra; of chronic endocervicitis; of certain rare forms of chronic endometritis; of certain equally rare cases of hypertrophy of the endometrium; of sterility and for the removal of products of conception that cannot otherwise be extracted. The principal use of curettage is to secure endometrial tissue for microscopic study.

If we contrast this scope of the indications for curettage, as legitimized by progress in scientific medicine, we will at once note its conflict with the daily routine application of this surgical procedure. It is with a sense of great loyalty to my profession that I recall, with deep humiliation, the many former indications for curettage which have been discredited.

Among these was the routine curettage incident to pelvic plastic surgery. If repair of injury to cervix or vaginal wall or perineum were to be made curettage was added, and its technic included gauze drainage or irrigation, one or both. A snap diagnosis of chronic endometritis was usually the term that was added to the operative diagnosis. Microscopic examinations of the scrapings were rarely made and still more rarely recorded. Sometimes variations in diagnosis were noted, such as chronic metritis, chronic hyperplasia, subinvolution, etc. Oftentimes the only symptom of these various diseases was a uterine discharge which was manufactured by the cervical mucosa. A very common indication, now discarded or dis-

credited, was incomplete abortion, and, if fever were present, the operation was considered imperative and of a "life-saving" type. We now know that invasion of the vagina or uterus in such conditions is not only very hazardous but decidedly unnecessary; that, except in case of very dangerous hemorrhage, such conditions are best treated without such invasion.

As a supposed stimulant, curettage has been often employed in treating uterine hyperplasia. The philosophy of it was illy founded. Cure of cancer of the body of the uterus has apparently been secured by curettage. Possibly the disease in these instances was so early and superficial as to have been entirely removed by the curette, and yet here we are confronted by many warnings of the danger of cancerous contamination in cutting surgical operations for this disease. Ignoring these well-founded warnings one can scarcely lay claim to such refinement in preoperative diagnosis as to be able to select cases for such treatment of cancer of the uterine body. In metrorrhagia incident to retroversion of the uterus it is common practice to curette without effort to right the malposition. In this type of hemorrhage the use of a proper pessary is usually ample treatment. In other uterine hemorrhages, from cardiac or other conditions outside the uterus, the curette is too often employed in place of careful study of the causes. Especially is this the case when loss of endocrine equilibrium is the cause.

Dangers. It is well to point out the many dangers incident to uterine curettage. Not infrequently is a pregnancy in its first month thus scraped from the uterus and perhaps never recognized. Certainly humiliation has often come to the operator by discovering during curettage that an unsuspected pregnancy has been interrupted. Very often, too, pregnancy has unnecessarily been ended by curettage for incomplete abortion. The literature teems with reports of cases of perforation of the uterus by the curette, with or without dangerous sequelæ, and even death. In the *Index Catalogue* mentioned are found titles like these: "Resection of seventy inches of intestine after perforation of the uterus with the curette"; "Perforation of the puerperal uterus: pelvic peritonitis; drainage of uterus

and parametrium; colpotomy; recovery"; "Two cases of death following curettage with perforation of the uterus"; "Laparatomy three hours after curettage and perforation of the uterus; 17 cm. of gut drawn out of the uterine cavity; uterine wound closed: recovery." Infection plays a major part in the fatal cases usually and to a lesser degree in the remaining ones. For various and oftentimes obvious reasons by far the larger number of such perforations are not published. Nor are they, by

TABLE SHOWING INCIDENCE OF BACTERIA IN CULTURES FROM GROUND ENDOMETRIUM OBTAINED AFTER HYSTERECTOMY

Type of cases.	Number of cases.	No growth.	Growth.							Remarks.
			Total number.	Gonococcus.	Streptococcus.	Diplococcus.	Diphtheroid.	Bacilligram.	Mixed.	
Nullipara *without* history or gross evidence of infection.	26	23	3	..	1	..	..	..	2	The two cases with mixed growths were curetted a few days previously.
Nullipara *with* history or gross evidence of infection.	13	12	1	1	..	..	..	..	..	One case revealed chronic tuberculosis, no bacteria were obtainable from one case with distinct inflammatory changes.
Parous women *without* history or gross evidence of infection.	47	43	4	..	1*	..	1	1	1	1* anaërobic mixed growth from a case subjected to preliminary intra-uterine manipulation.
Parous women *with* history or gross evidence of infection.	32	23	9	5	2	1	1	..	..	One streptococcus case packed to control bleeding two days before operation. All others except diphtheroid bacillus case yielded similar growth from the Fallopian tube.

any means, confined to the unskilled operator. Often infection without perforation is a sequel and often latent tubal infection is thus aroused to activity. "Hyperpyrexia following curettage of the uterus" is another title found in medical literature, and is quite *apropos*.

How often curettage brings away a premenstrual thick membrane that brings from the pathologist a report of chronic endometritis! Close questioning of the latter brings slow ad-

mission that no genuine characteristics of existing inflammation were present. But the surgeon is cheered by the confirmation of his diagnosis and he has no doubt of correctness of both diagnosis and treatment.

The invaluable paper of Arthur H. Curtis furnishes much valuable information concerning the bacteriology of the endometrium, with and without instrumentation of it, and I take the liberty of copying his tables of results:

We find in this table that in 26 nullipara, *without* history or gross evidence of infection, 23 gave no growths from the endometrium and in 2 of the 3 furnishing growths, mixed infection was found. These 2 patients had been curetted a few days before. In 13 nullipara *with* history or gross evidence of infecfection but 1 showed a growth—the gonococcus. In 47 parous women *without* history or gross evidence of infection but 4 showed growths. In one of these a prolapsed uterus removed *per vaginam* a few colonies of short Gram-negative were found scattered among several tubes of media—probably from contamination in operation. Another showed contamination by diphtheroid bacilli, leaving but 2 cases for consideration. In one of these curettage and dilatation were done as a preliminary to hysterectomy. In the remaining case curettage was done seven years before for persistent bleeding following spontaneous abortion. Thirteen months before hysterectomy bleeding again ensued and became a constant oozing. In this case he found numerous pus cells and several colonies of anaërobic streptococci in pure culture. In 32 cases of parous women *with* history or gross evidence of infection 9 showed growths. One case, with hemolytic streptococci in cultures, had been packed to control hemorrhage two days before hysterectomy. One other, opened at operation, furnished only diphtheroid bacilli. Eliminating these 2 cases 7 infected ones remain; 5 show chronic gonorrheal infection in endometrium and tubes. In 1 were found non-hemolyzing streptococci in the endometrium and tubes.

He concludes that the endometrium of nullipara, without history or gross evidence of pelvic infection, is almost invari-

ably free from bacteria and microscopically normal; that almost all women who have undergone normal pregnancy, with pelvic history otherwise negative, likewise possess bacteria-free endometria; that patients with a history of chronic infection, from whose endometria bacteria are obtainable, almost all have salpingitis, with equally good growth; that, pyometra and recent exploration of the uterus excepted, the endometrium almost never shows bacteria except when there is infection of adjacent pelvic tissues, and that chronic endometritis, *per se*, with bacteria present in smears or cultures, is practically to be ruled out as a clinical entity.

Such data indict the curette and other instruments when introduced through the cervical canal into the uterine cavity. The cervical canal is so constantly infected that it does not seem strange infection may be carried from it into the uterine cavity by curette, sound or dilator. Again it is shown by Curtis that infection of the endometrium is nearly always associated with similar infection of the tubes and most often gonorrheal. Curettement under such conditions is strongly contra-indicated. It would seem, then, the dangers from curettage are ever present, whether in the hands of the skilled surgeon or of those of his less fortunate *confrère* or of the midwife, and should be practically excluded from the infected uterus. If chronic endometritis as a clinical entity is to be ruled out, one potent indication for curettage in the past will be removed.

If bringing this subject to your attention will appeal successfully to your aid in bringing about harmony between the use of the uterine curette and the teaching of gynecological pathology and bacteriology, I will be deeply gratified.

DISCUSSION

Dr. Guy Leroy Hunner, Baltimore, Maryland.—This is a timely paper that Dr. Bovée has brought before us, and he has handled the subject in an excellent manner. I think there are

few gynecologists of large practice who do not, at least once a year, and usually oftener than that, have to handle cases of pelvic infection or of general septicemia in which the history is obtained that the patient was curetted in some physician's office for a supposed abortion, or possibly to bring on an abortion, or for some supposed disease, very often to cure a leukorrhea which, as Dr. Bovée has so well said, is usually dependent upon a cervical condition rather than uterine. There must be something radically wrong with our medical schools, or there is a great lack of feeling of responsibility on the part of men who are turned out of our schools when this thing can be so prevalent in the profession. It is a very important matter I think for us to impress on the profession as far as we can the dangers of promiscuous curettement.

I have been particularly interested in the damage done by curettage in the cases of sterility that come to me. A woman comes in complaining of sterility; perhaps she has been married five or six years, and gives a history of having been curetted by practically every man that she has seen about this condition before. On carefully swabbing the cervix of such a patient with tincture of iodin and passing the uterine sound, one finds not one point of obstruction to the sound where it passes the internal os of the uterus, but usually several points of obstruction showing partial atresia throughout the cervical canal and well up into the uterus. This indicates that these curettages from a mechanical standpoint have done the patient more harm than good. You will find on taking such a history that the husband has not been examined for the question of virility, and that is another thing we ought to impress upon our medical students —never to interfere with a woman in any case without finding out first the virility of the husband. I find in my practice that fully 30 per cent. of the patients coming to me complaining of sterility have been operated upon one, two, or three, or more times, when a simple examination of the husband's semen shows that it was impossible for these women to have children.

Dr. Reuben Peterson, Ann Arbor, Michigan.—This is a most timely paper. One of the great advantages of a meeting like this is that it sets you to wondering whether in the commonest routine you have been right and also whether your teaching has been correct. Dr. Bartlett has said that usually

water is not absorbed by the rectum but runs out into the bed. That is certainly news to me and I shall verify the correctness of the statement upon my return.

All of us, I imagine, are becoming more conservative in the use of the curette. In my own clinic my assistants are warned against the use of the curette as a routine procedure. The burden of proof as to the necessity of curettage rests with the gynecologist. In skilled hands the uterus is rarely perforated by the curette, but the same cannot be said of those who are unskilled yet who think they are perfectly competent to perform this simple operation. Not infrequently the curette is used so harshly that the musculature is exposed with resulting atresia of the uterus. In not a few cases persistent amenorrhea dates from a curettage. There is no worse practice than routine dilatation and curettage as a cure for sterility in young women married five or six years who have no uterine disease.

Dr. Thomas S. Cullen, Baltimore, Md.—Dr. Bovée has told us that endometritis is not nearly as common as it is thought to be. This has also been our experience. In 1898 at the annual meeting of the Medical and Chirurgical Faculty of Maryland I reported our findings for the four previous years. All material from curetting and the mucosa from every uterus removed at the Johns Hopkins Hospital were carefully examined histologically. During the four years I found but 48 cases of endometritis. In other words only one a month in a large gynecological service. Even in those cases where bilateral pus tubes existed the endometrium was usually normal.

There is one pathological conditions of the endometrium where curetting is clearly indicated, that is in hyperplasia. In these cases the periods are long and most exhausting, but there is no intermenstrual bleeding. The mucous membrane is much thicker than normal. Many of the glands are large, others small and there is a great increase in the number of stroma cells. There is a marked increase both in the epithelial elements and in the stroma cells, hence the name hyperplasia which we originally gave to this condition. Curetting will relieve the bleeding for three or four months. Sometimes it is necessary to curette three or four times before the patient is permanently relieved; in other cases it has been necessary to remove the uterus.

Radium will effectually stop the hemorrhage. I know of no case where as a result of the ordinary curettage an early pregnancy has been removed. Had such a thing happened we would have found placental tissue or decidua in the scrapings. Our students are taught never to think of curetting a uterus where tubal infection is suspected.

Dr. Bovée (closing the discussion).—I have nothing further to say except to emphasize one of the points brought out by Dr. Peterson. What I said in connection with hypertrophy was not hypertrophy of the uterus, but hypertrophy of the mucous membrane lining the uterus, which was pleasing to the surgeon. When he scraped out this thick mucous membrane he thought he had ample reason for curettage. That was all. He scraped out normal mucous membrane before menstruation, feeling he was doing that patient a wonderful amount of good by taking out all this debris while he was really scraping out normal tissue.

THE OPERATIVE TREATMENT OF PELVIC INFLAMMATION

By Charles R. Robins, M.D.
Richmond, Va.

The observations in this paper are based on a series of over 500 cases. These cases are not tabulated, as this would add nothing to the value of the paper. No special originality is claimed for any of the views or procedures referred to. They are shared, I believe, by others of large experience. My special interest in the subject is due to the fact that I was among the first to oppose radical operation in acute cases and to make use of Fowler-Ochsner-Murphy method in treatment, which was exactly opposite to the methods employed at that time. My first case was one in which I was unable to make a positive diagnosis between a late case of acute appendicitis and pelvic inflammation. Subsequent observation and operation proved it to be one of acute pelvic inflammation. The rapid improvement under the treatment referred to and the easy convalescence from the operation led me to adopt it in other cases, with most satisfactory results. The other conclusions and technic were gradually evolved from experience and from the views of others, but the principles of treatment and technic referred to in this paper have been those adopted some years ago and worked out in a large number of cases, and I believe solve many of the problems that arise in the consideration of the treatment of pelvic inflammation.

Pelvic inflammation is responsible for a large amount of pelvic pathology. While most other pelvic pathology of long standing will eventuate in a certain amount of tubal disease

associated with it that will call for appropriate treatment, we are concerned in this paper only with those cases that are primarily inflammation. We do not refer either to tubercular disease or secondary inflammation from some other source, as, for instance, appendicitis.

When we come to consider cases that are primarily due to inflammation it will be found that they have their origin in two principal sources, gonorrhea on the one hand, and on the other infections incident to abortion or labor at term. These two types of infection are widely apart as to their relation to operative treatment. Gonorrhea may be regarded as a local inflammation, with little tendency to absorption. While early operation is not to be advised as a routine procedure, as a matter of fact these cases can be operated at any stage with practically no risk to life and no necessity for drainage. The local nature of the infection is borne out by the fact that while it may be attended with a great deal of pain and disability, we do not often have a great rise in temperature, 100° to 101° being about the maximum. Neither do we have any marked acceleration of the pulse, and the leukocyte and differential count are not indicative of a severe form of infection. Notwithstanding this general rule, it is true, of course, that we do have absorption of the gonococcus into the blood at times, and this is evidenced by endocarditis, joint infection, etc. But these cases are comparatively infrequent, certainly in the female, when the great number of cases of gonorrhea is taken into account.

On the other hand, those infections following abortion or labor at term present every evidence of systemic infection, and absorption is, as a rule, the predominating picture. We are really dealing with a septicemia. This is noted by chills, high temperature, rapid pulse and a blood count indicating a severe form of infection. Sometimes the infection remains localized in the uterus and sometimes it extends beyond into the tubes and involves the peritoneum or into the pelvic connective tissues. These infections may be due to a variety of organisms, and it is sometimes difficult to tell exactly which germs are

concerned. They have, however, a more or less common symptomatology, and may, for practical purposes, be grouped under one head. In any case the condition presented is a grave one. It is just in these cases that we are liable to do the wrong thing. The condition of the patient would appear to call for heroic treatment. If, however, an operation is undertaken at this stage it will be found to be attended with a very high mortality which runs from 50 to 75 per cent. The reason for this is not far to seek. We are dealing with septicemia, due to absorption, and operation does two very bad things—it increases absorption by breaking down the walls of protection and at the same time the resistance of the patient is lowered by prolonged and tedious operation under general anesthesia. What is indicated in these cases is, not operation, but a method of treatment designed to diminish absorption and to increase the patient's resistance, and particularly to allow time for the assembling of nature's forces for the resistance of the infection. This is best accomplished by the line of treatment commonly used for peritonitis, and consists of absolute rest in bed in the elevated position, saline by rectum, ice-bags over the abdomen, withdrawal of food and no purgation. The pelvis is particularly well situated to prevent spread of inflammation, and in ordinary cases and under proper management there is comparatively little danger of general peritonitis. It will surprise any one who has not seen it done to note how quickly in a majority of cases all the symptoms will subside and the patient enter into a period of convalescence. The only indication for operation at this stage is the formation of an abscess, which can be evacuated by either vaginal puncture or a muscle-splitting operation in either iliac fossa should the abscess be pointing in this direction. By this method the mortality may be reduced from 50 per cent., the operative mortality to about 2 per cent.

In addition to this it is undoubtedly true that under favorable conditions many of these cases of septic infection have a marked tendency to undergo resolution, so that the entire inflammatory exudate may absorb away. This may eventuate in a symptomatic cure, in which the patient recovers her health;

but the tubes are permanently closed by adhesions or occlusion, or, in an absolute cure, in which the patient recovers her health and the tubes function, as is evidenced by subsequent pregnancy.

These observations have a very important bearing on operative treatment, because it may be said that while there are exceptions, as a rule, operations for pelvic inflammation do not belong to the life-saving class. There are safer and better ways of dealing with them than by operating, and delay is an advantage. We are then able to perform deliberately such operations as will best promote the health and welfare of the patient.

A consideration of operative treatment implies a consideration of the disabilities from which we hope to relieve the patient, but only brief reference to these will be made. The amount of ill-health, as a result of chronic pelvic inflammation, varies a great deal, possibly due to an extent, at any rate, to the susceptibility of the patient. We often find cases in which the pelvis is filled with exudate, but the patient appears to enjoy reasonably good health and very little pain or discomfort. On the other hand, many cases lead a life of invalidism or semi-invalidism. Pain and discomfort are almost invariably present, but vary a great deal. Often the patient is unable to take necessary exercise or attend to her household duties. Recurring attacks of pelvic inflammation are of frequent occurrence. These cases are those in which a focus of infection or one or more small abscesses are present, which are temporarily overcome by body resistance, but become more or less active following exertion, menstruation or increased congestion from various causes or where there are adhesions to the intestinal tract which reinfect from time to time. Painful menstruation is not present as often as would be supposed. Its degree has a direct relation to the ovaries in most cases. When the ovaries are encapsulated in adhesions, particularly when they are firmly bound down to the pelvic wall, the pain is often excruciating. The reason for this is that when the normal congestion takes place at the time of menstruation the ovary cannot expand, owing to the dense wall of adhesions, and the effect is

the same as if it were being violently squeezed. I have often been able to demonstrate the relation of this condition to violent pain at the menstrual period. When the ovaries are so situated that they can expand freely there is often no pain. The same condition is present to a lesser extent when the uterus is incarcerated and bound down by dense adhesions.

Metrorrhagia is frequently present irrespective of the condition of the endometrium, and is due to increased congestion. Chronic toxemia is almost invariably present, and, although the patient may appear to be in reasonably good condition, there is almost always a marked improvement following removal of the foci of infection. Dyspareunia is almost uniformly present, and is doubtless the cause of much of the discomfort and annoyance to which the patient is subjected, although she may not refer to it.

No reference has been made to sterility, because I doubt very much the practicability of attempting to restore the function of the tubes. Occasionally we read of successful cases, but they are very infrequent, and most often our attempts will not only be unsuccessful; but another operation will become necessary. However, this is a case in which the wishes of the patient must, as a rule, determine. In favorable cases, and when the patient understands the probable failure and the possible necessity for another operation, it may be undertaken, but not as a routine. Ordinarily we will have to assume the position that the disease has caused the sterility, and that in the operation we can only remove the disease. While the removal of the tubes is practically always advisable, it is seldom necessary to remove more. The object of conservative operation in the pelvis is to preserve menstruation. This means the preservation of the uterus and the ovaries. If menstruation is stopped, it is better to make a clean sweep of the pelvis. Pelvic inflammation is usually found in young women, and the preservation of the menstrual function is of vital importance to them. Notwithstanding that when the abdomen is opened we often find a mass in which the various organs at first cannot be distinguished, a little patience in separating adhesions along their normal lines of cleavage

will enable us to separate from the mass a more or less normal uterus, and while at first the ovaries may be completely hidden by the adherent and encircling tubes, when we have separated them the ovaries will be found to be very nearly normal. In other cases one or both ovaries may be involved in the tubo-ovarian abscess or contain an abscess. If one ovary is sound it can be retained, or, if both are involved, both can be resected; or the most favorable one resected and the other removed. It is surprising, however, how often we can peel out from its bed of adhesions a perfectly sound and normal ovary.

I have always found that separation of adherent tubes was best effected by commencing in the midline on the posterior aspect of the uterus and vagina as low down as possible. From this point I work up and toward each side. In this way the adhesions seem to give with greater ease and we are able to effect separation with the minimum amount of tearing and trauma. A complete separation and isolation of each organ should be effected before any removal is practised. We are thus able to examine all the structures and determine definitely what we are going to do. The following are the procedures that I have followed almost uniformly in operating: If the ovary is to be left, the ligature controlling the blood supply from the ovarian artery is placed between the ovary and the tube. Another ligature is placed with a needle to encircle the horn of the uterus and to include the uterine artery. The uterine portion of the tube is then excised by a V-shaped incision, and, when the uterine artery is cut through, the ligature which has been placed is tightly tied, thus closing the aperture in the uterine wall and controlling the bleeding at the same time. The tube is then removed by incising the broad ligament close to the tube, always being on the lookout for a bloodvessel that comes in about the center of the tube. The broad ligament is then repaired by suturing, bringing the infundibular border against the horn of the uterus. This at the same time brings the ovary up against the posterior aspect of the uterus, where it is not likely to become involved in adhesions or be pressed upon.

Another procedure which I uniformly practise in all cases of pelvic inflammation is the temporary suspension of the uterus. A very interesting paper on this subject was read before this Association by Dr. E. H. Ochsner in 1908. He stated in his paper that he had been performing this operation for seven years. His experience has been the same as mine in that he had operated for cases of pelvic inflammation and found, on subsequent examination, that the uterus was densely adherent in a position of retrodisplacement. To overcome this very distressing sequela various methods have at times been advocated, even to the complete removal of all of the pelvic organs. In view of the fact that such inflammations are most frequently encountered in young women, such a procedure is, of course, undesirable, to say nothing of the added dangers of doing a more severe and exhausting operation on a patient already debilitated.

I had myself been making use of the same technic for some years previous to the time I heard his paper, and at the time the paper was read it was generally commended. However, although I have made no search of the literature, I can state that I do not recall having heard or read any reference to this procedure since. Whether this is because its use is so general that no one has thought it worth while to refer to it or whether no one but Dr. Ochsner and myself are doing it, I do not know. It might, therefore, be interesting to refer to the subject again. The procedure and the reasons for performing it are very simple and can be stated in a few words. In quite a large number of conditions in which operation is indicated, after the operation is completed, we find lying behind the uterus denuded areas and areas of organized lymph or blood clots. The more common of them are old ectopic pregnancies and various degrees of pelvic inflammation. When we have an inflammation or any other pathological condition of the tubes, they naturally drop in Douglas's cul-de-sac, where they become adherent, and in removing them we leave behind raw surfaces. If nothing is done to the uterus it drops back into relation with these raw surfaces, and in a large percentage of cases will

become densely adherent. This is a condition that is invariably pathological. In order to prevent this it is necessary either to remove the uterus or to hold it forward out of contact with the denuded area. The various ligament operations are not so satisfactory, because while they may hold the fundus forward they do not lift it out of contact. This, however, is readily accomplished by suspending the uterus to the anterior abdominal wall. If the uterus is retroflexed or markedly retrodisplaced the suspension should be made a permanent one by using kangaroo tendon or some other method of accomplishing this result. The removal of the tube will, of course, prevent any further pregnancy, and therefore we will have none of the complications that result from suspension of the uterus followed by pregnancy. In many of the cases, however, there is no retrodisplacement of the uterus, and it is only necessary to hold the uterus up for a comparatively short time until the raw surfaces have healed over. This is done by making the suspension with plain or iodized catgut. The healing over of the raw surfaces takes place quickly, and also the absorption of the catgut, and in clinical experience I have found in subsequent examinations that the uterus had dropped away from the abdominal wall, is in normal position and freely movable, and that the patient is suffering from no pelvic discomfort or other evidence of pelvic pathology. I do not think that any elaborate technic is necessary, and as far as complications are concerned, I do not recall ever having encountered any. The procedure is a simple one, but I believe it makes the difference between success and failure in securing results from operations for pelvic inflammation.

If pus is found outside of the tubes, or if there is oozing which cannot be satisfactorily controlled, drainage may be practised; but, as a rule, it is not necessary. When done a glass tube is used, the curved end placed in the bottom of the cul-de-sac and in this are inserted one or two strands of gauze. The tube is tied in the wound with the free ends of a suture and the wound otherwise closed. The gauze is removed from time to time, as is indicated, and drains away the fluid as it

accumulates. As a rule it is only necessary for the tube to remain in position for a few days.

Conclusions.—1. Pelvic inflammation is most frequently due to one of two causes, gonorrhea or infections following abortion or labor at term.

2. These two types differ widely as to methods of treatment. Gonorrheal cases are, as a rule, local in their effect and are not attended by symptoms of absorption. Infections following abortion or labor at term, on the other hand, always manifest symptoms of intense absorption and are of the nature of a septicemia.

3. Operation on gonorrheal cases may be performed, with comparative safety at any stage, but radical operations on the septicemic group in the acute stage are attended by a high mortality and should not be done.

4. Delay in operation on the septicemic group is an advantage, is less dangerous and often results in symptomatic or absolute cure.

5. The best method of treatment is that usually known as the Fowler-Ochsner-Murphy treatment.

6. The cases in which operation is indicated are those which have passed into the chronic stage. Gonorrhea may be considered as operable at any stage, but a moderate delay is permissible.

7. In operation it is seldom practicable to restore the function of the tubes. They really become the foci of infection; their removal stops the toxic process, and if they are left, further trouble is liable to manifest itself.

8. The objects of the operation are to remove the tubes and preserve the essential organs of menstruation, the uterus and the ovaries.

9. The details of operation on which emphasis is laid are the complete removal of the tube by excising also the uterine portion, the attachment of the broad ligament to the horn of the uterus, thereby elevating the ovary away from pressure and adhesions and the temporary suspension of the uterus.

DISCUSSION

Dr. S. M. D. Clark, New Orleans, Louisiana.—It has always interested me to hear discussions on pelvic inflammatory disease; to listen to speakers heartily approve the rest method, condemn any surgical activity during the active condition and then finally to see what they are actually doing in their daily work. Some men, while under stimulus of debate, preach a beautiful sermon on the criminal phase of attacking this condition while acute and the next day one will find this same speaker operating on a pelvis that is in the height of inflammation. Two years ago I reviewed 6000 cases operated in the Charity Hospital by various operators. The deductions were valuable since they showed that the surgeon who properly prepared his cases had a primary mortality of 1.2 whereas those that did not ranged from 9 per cent. to 16 per cent. The morbidity and end-results will not be discussed now. My one purpose in this investigation was to impress upon the hospital authorities the need of setting aside a rest ward for all cases of pelvic infection. It is perfectly human for one to grow impatient in seeing his beds full with long rest cases; he needs material for his classes, and under pressure patients are put on before they have even approached the required condition. The cardinal laws of F. F. Simpson form an excellent guide in pelvic inflammation. His last analysis reduced his mortality to 0.5.

The great point is to get away from the weakness of the operator. All pelvic infections should be transferred to the rest ward, this ward being in charge of one in no way connected with the contemplated operation. When a case has fulfilled the required regime she should be sent back to the original service. By this plan it will be found that in at least 20 per cent. of the cases there will be no need of surgery and when it is done the primary and end-results will be vastly different than when the elective period is determined in the routine surgical service.

Dr. Harley R. Shands, Jackson, Mississippi.—In the main, I agree entirely with the conclusions of the essayist. I believe, however, that very occasionally cases will occur in which it is best to proceed with an immediate operation. I recall one case

of a little girl, aged three years, who was sent to me with a diagnosis of acute appendicitis. Upon examining her I found that she had a vaginal discharge containing gonococci and that the abdominal symptoms had only developed that day. I made a diagnosis of acute gonorrheal salpingitis and did an immediate operation, removing both tubes which were dripping pus from their fimbriated extremities. No adhesions had yet formed and the ovaries were entirely undiseased. Both ovaries were of course left.

I have had 3 or 4 cases similar to this and every time with prompt operation before there was any inflammatory exudate in the pelvis the patients made speedy and uncomplicated recoveries, that is, in two weeks' time the patients were to all intents and purposes well. My experience has been that, if these cases had been treated more conservatively, they would have had to remain in bed a month or more and would have had diseased tubes and ovaries, which would probably have necessitated a more serious operation at a subsequent date. I realize that it is very seldom that one can see a case of gonorrheal salpingitis on the very day that the infection spreads into the tubes. However, if a case can be caught just at this time I think the indication is similar to the indication for a very prompt operation for an acute osteomyelitis. I don't think the most conservative one claims that the tubes are ever saved as sound organs after an acute gonorrheal infection in the tubes. The prompt operation suggested above only removes these tubes and leaves perfectly uninvolved ovaries. The patient is saved several weeks, and it may be months, of suffering, and has no more removed than the disease would necessarily make entirely useless. The painful inflammatory exudate around the ovaries is entirely prevented by this very prompt operation. I realize, of course, that not one case in ten will be seen on the very day that the inflammation spreads into the tubes. However, the symptoms that occur on the day which this inflammation does spread to the tubes are most striking, and this condition in my experience can be recognized definitely and promptly, if the case happens to be already under observation for the treatment of a gonorrheal infection.

Dr. Guy Leroy Hunner, Baltimore, Maryland.—It seems to me, the statements of the last speaker should not go by in a

meeting of this sort without some difference of opinion, at least, although it may be getting a little off from Dr. Robins' paper. As to the question of what to do in these early cases of gonorrhea, if you can make up your mind from the examination of the vaginal discharges and from the other evidence in the case you were dealing with acute gonorrhea, either confined to the tubes or beginning to spread to the peritoneum, I believe firmly we should not operate, but put the patient at rest and follow conservative methods. And this applies particularly to children. The reason children die from gonorrheal peritonitis is that we do not see them until they have had peritonitis for a week or more. They have not the faculty of letting people know just how sick they are. The parents do not take them to a doctor, and they are walking around until gonorrheal peritonitis has been replaced by streptococcus infection or some other form of peritonitis, and they die. If we can make the diagnosis that the child has, in all probability, an acute gonorrhea, do not operate on it, as the child will get well. In the chronic form the same thing applies to adults with pus tubes, and most of them will not need an operation at all if we can get them in the early stages and put them to bed.

Dr. Edward H. Ochsner, Chicago, Illinois.—In pelvic infections we ought to differentiate as to whether the infection is gonorrheal, septic or saprophytic. I would say a word or two about septic infections. For twenty years at the Augustana Hospital we have adhered strictly to the practice of waiting in septic infections of all kinds until the line of demarcation has developed, until the septic area has been excluded by the leukocytes, and also until immunity has been established to a certain extent at least. In septic infections you get a line of demarcation in five or six days, and a certain degree of immunity by the eighth or tenth day, and, when the temperature goes down to normal or nearly normal, then is the time to operate. Do not wait until pus is going to be absorbed, for two reasons: because absorption of the pus may cause septicemia, and, if you wait more than two weeks it is more difficult to remove the infected structures. Up to about two weeks it is easy to find the line of cleavage and shell things out. I have made one observation since doing this, namely, that if one will wait for just the right

time for operation, the time of healing is very greatly reduced. It is not an unusual thing for a patient with a pelvic infection, or with an appendiceal infection, to be absolutely healed in three weeks and sometimes in two weeks. In the old days, when we operated early before immunity was established, it was a rare thing to have real severe pus infections of the abdomen healed in less than four weeks. I have seen such cases drag along for six months twenty-five years ago.

Dr. Robins referred to a paper which I read at the St. Louis meeting in 1908. There is one reason why that method of treatment has not been generally adopted, namely, because it is too simple; it is so easy that practitioners do not take any interest in it. I am a strong advocate of simplicity in surgery. If, instead of removing the uterus in these severe pelvic infections one will supplement the operation by a temporary ventrosuspension, the mortality is certainly reduced; if in place of doing a round ligament operation or a broad ligament operation, one will simply substitute a temporary ventrosuspension, not only will the mortality be reduced but the morbidity will be reduced very greatly. The first 33 cases of temporary ventrosuspension which I did, I followed carefully for a number of years after the operation and in not one single instance did a retroflexion occur nor was the uterus adherent to the anterior abdominal wall so far as I could determine. I have had an opportunity to examined quite a number of these cases operated on by some of our most expert operators, who used the broad ligament operations for this condition, in whom I found the uterus making a plug in the pelvis causing chronic constipation with all of its sequelæ and its high rate of morbidity. In fact, I have had to reoperate upon a number of these cases to relieve this condition. In my cases where the simple temporary ventrosuspension was used, a second operation has never been necessary. However, the incision in the abdomen must not extend quite so far down as usual, in order that the uninjured peritoneal covering of the uterus may be brought up against the uninjured, unabraded peritoneum of the anterior abdominal wall. If this precaution is taken there will be only two small puncture wounds in each of these structures and if ten-day unchromicized catgut is used the uterus will be loose at the end of ten days and no further trouble will be experienced.

Dr. Bovée.—I would like to ask Dr. Ochsner what he means by the uterus being loose, whether it is absolutely detached from the abdominal wall?

Dr. Ochsner.—In the 33 cases which I reported in 1908 there were two who had to have subsequent abdominal operations. In each patient there was extensive pelvic infection and in each case I took out only the worst ovary and a part of the best, leaving a part of the best ovary, to escape, if possible, the undesirable symptoms of artificial menopause. Some six or eight months later I had to reoperate on each one of these cases and remove the second ovary. In each case the uterus was in absolutely normal position, freely movable and not attached to the anterior abdominal wall.

Dr. F. G. DuBose, Selma, Alabama.—When Larrey was about to operate on Josephine, Napoleon called him aside and said, "Forget she is the Empress of France. Treat her like a washerwoman." We have two clinics in my town. One in a colored hospital, where everything is unfavorable; and one in a private institution where we have everything as favorable as can be made, where every means we know is used for conservative treatment of pelvic inflammations. On account of economic conditions, and having to take care of the sick of 300 negroes without any charity organization, the economic phase in that colored hospital is an important one. I am impressed by the fact that these colored patients under many disadvantages get along better than white patients do in the other hospital with every advantage, and I believe the reason resolves itself into complete operation in all acute inflammations of the pelvis in the case of the negroes. Radical surgery in other words, and copious drainage, as opposed to conservative surgery, used in the white hospital.

Very recently, I heard an essayist minimize the importance of drainage in these cases, saying that the more he operated, the less he drained. I would like to change that statement; the more I operate, the more I drain. These colored women, who come in with every imaginable infection, are operated on as soon as possible. Everything diseased in the pelvis is removed as completely as possible, regardless of whether it is gonorrheal, streptococcic,

or staphylococcic infection. The pelvis is packed full of gauze overlaying the gauze with rubber dam or tissue. I do not know of any of these cases that have failed to get well. Maybe the negro is inherently stronger, or has acquired an immunity to infection greater than the white person, but rarely do any of these colored patients fail to get well, and they are taken indiscriminately. About fifty or sixty negro women are operated there a year for pelvic infection, whereas at the other place, we have two hundred or more abdominal sections a year for pelvic infection. I have noticed in the clinics men putting in wicks of gauze after removing pus tubes. My conception of drainage is certainly larger than a strip of gauze an inch or two long, wrapped around by a piece of gutta percha tissue. We pack the pelvis with iodoform gauze and cover it over with rubber tissue, and the result is satisfactory. Radical surgery and ample drainage is the best treatment for acute pelvic inflammations.

Dr. Lewis S. McMurtry, Louisville, Kentucky.—This association was founded as a gynecological society, to promote and diffuse knowledge of the new surgery throughout the southern States. In the earlier years four-fifths of the papers and discussions were upon gynecological subjects. In later years an impression has prevailed that gynecology is a completed science and its practice standardized; that discussions of gynecological subjects are tame and unprofitable, and that all controversial questions related thereto have been eliminated. In consequence our attention has been directed to the surgery of the upper abdomen, to bone surgery, and general surgical topics. Even the name and title of the association have been changed to conform to this view. From the discussions of this morning it seems that we have made an error, and that we had best get back to the beginning and go over these subjects again. (Applause.)

The subjects of both papers under discussion relate to elementary gynecology, and we find wide diversity of teaching as to principles and equally wide diversity as to practical application of methods of treatment. This is of the utmost importance. The profession as a body regards the pronouncements of this association as authoritative, composed as it is for the most part of teachers, authors and specialists in the various branches of surgery. Hence it is not just and proper, from my viewpoint,

that many of the teachings promulgated here this morning should go out to the professional public without protest.

Dr. Bovée's paper ought really to have been presented to a large body of general practitioners, such as assemble in our State societies. In a general way curettage is the most abused operation performed in general practice. Its limited scope and harmful sequelæ are recognized by such surgeons as are assembled here. It is a melancholy observation that practically every woman who comes to the special surgeon for treatment of definite diseases of the pelvic organs has been curetted by the general practitioner in advance. The majority of young married women who seek the doctor's advice for sterility are treated by cervical dilatation and curettage. That the presumptive diagnosis of cervical stenosis and retention is erroneous in the great majority of cases is well known to surgeons who have made careful study of such cases. Dr. Bovée has presented an admirable exposition of the pathological basis for intra-uterine invasion, and the evil results of injudicious and indiscriminate use of the curette.

Under the heading of infections of the pelvic organs is comprised the largest class of diseases peculiar to women. The paper just read upon this subject is very comprehensive. The judicious application of surgical treatment in this class of cases has established one of the most brilliant chapters in surgery. The evolution of this subject from the crude pathology of pre-antiseptic times to the perfect knowledge and treatment of the present can be traced in the early volumes of this Society's Transactions. Dr. Ochsner has alluded to the simplicity of operative methods, which is as a rule the culmination of perfected knowledge and precision in treatment. I would protest, however, that this practice of suspending the uterus to the abdominal wall after removal of suppurating appendages, when the peritoneal surfaces are covered with inflammatory products, is unsurgical and harmful. It is questionable whether the uterus should ever under any conditions be suspended by suturing that organ to the abdominal wall; certainly not in the midst of established inflammation of the pelvic organs and pelvic peritoneum.

In this connection I would call attention to the admirable paper on this subject by Dr. F. F. Simpson, of Pittsburgh, read before the American Gynecological Society in 1912. By the

study of a large group of these cases, he formulated definite rules, based upon temperature and pulse observations, by which operative intervention could be applied with practically assured good results. All of us who serve in the gynecological wards of large general hospitals know how difficult it is to hold the average patient in the hospital until the acute stage is passed and the infected area circumscribed. Disaster is often the result of yielding to the importunity of interne and patient to operate prematurely. The suggestion of Dr. Clark to establish a rest ward for these patients, and thereby hold them over to the proper time for operation, is excellent.

I cannot but offer an earnest protest against the teaching of the last speaker (Dr. DuBose), who would resort to the glass drainage-tube and pack the abdomen with gauze. That is perhaps the worst practice we have ever passed through. I have not seen a glass drainage-tube for ten years, and I was under the impression that both the tube and large gauze packing in such cases belonged to operative methods now obsolete.

If the acute process has passed and the infected area is circumscribed, suppurating tubes and ovaries can be enucleated by patient, careful manipulation, repairing injured bowel if necessary, placing a cigarette drain in Douglas' space, and closing the abdomen. It is rarely necessary to remove the uterus. The refined and simple technic, the careful manipulation of viscera, the clean toilet, the exercise of sound judgment as to time of operation and drainage, have been evolved on the floor of this Society through years of stormy debate. If done at the right time and in the right way the mortality in a general hospital will not exceed 2.5 per cent.

Dr. E. Denegre Martin, New Orleans, Louisiana.—I want to protest against the statements made by Dr. DuBose in the treatment of the class of cases under discussion. I asked Dr. DuBose the question whether he had seen these patients after operation and he said that he had not. I not infrequently see these cases when they come back in six months with the usual complications which arise from this kind of surgery, and if he were to see these patients, I think, he would change his method of operating. It is impossible to operate on these cases in the acute stage and use a gauze drain without having adhesions of

all kinds and complaints of great suffering by the patient. I want to ask Dr. DuBose another question, namely, if he is so well satisfied with this procedure on negro women, why does he not adopt the same methods on his white patients? He has fallen into the same error that we did at the Charity Hospital, New Orleans, to which Dr. Clark has alluded. We tried to get rid of patients by operating on them several days before they had cooled down sufficiently, hence the high mortality. In several instances where I have opened the abdomen I found the condition was so acute that to attempt to remove all of the affected organs would have proved fatal. I have therefore closed the abdomen, sent the patients back to bed, and seen them go home in a short time perfectly well. A word or two in reference to the remarks made by Dr. Shands. If the operation he speaks of, removing the tubes and ovaries, is so successful in children or even in women, why not operate on men on the same principle for gonorrheal orchitis?

Dr. James M. Mason, Birmingham, Ala.—Following Dr. Ochsner's suggestion some years ago of temporary ventrosuspension, my experience has been much like that of Dr. Robins. I have used it in quite a number of cases with great satisfaction, and the advantages I have found for it are three:

1. The uterus is elevated where it does not drop back into the pelvis and form adhesions on the posterior pelvic floor.

2. A drain may be placed in the bottom of the pelvis, and if the uterus is held up by drain and ligature there is no trouble in reinserting the drain, and there is no danger of secondary accumulation.

3. With reference to attaching the uterus to the anterior abdominal wall, the greatest objection to an anterior fixation has been in subsequent pregnancy, but in these cases pregnancy rarely occurs on account of the pathological conditions present. If fixation occurs I prefer the anterior position rather than to have a heavy uterus adherent in a retroverted position. Those cases in which I have used this method have been satisfactory all the way through.

Dr. J. Wesley Bovée, Washington, D. C.—This subject is a very broad one, and I do not see how we can cover it in an

ordinary discussion. There are many points that have interested me very much. After listening to Dr. McMurtry's very interesting remarks on this subject, I am reminded very much of what Balzac accomplishes in his "Comedie Humaine." This discussion has been very much the same.

I was particularly impressed with the rejuvenation of the procedure Dr. Kelly originated and some years ago discarded, namely, the suspensio-uteri operation. I myself employed that procedure for a long time and discarded it, because there were too many articles appearing in the literature where the effect seemed to be similar to that of Meckel's diverticulum, namely, a strangulation of the intestine. I was quite impressed, after asking Dr. Ochsner a question, with the operation by which he attaches the uterus to the anterior abdominal wall for a period of time and then having it drop loose. I was impressed also with the fact of having uteri that would not drop back into the pelvis after the procedure. We do know this operation was devised by Dr. Kelly for retroversion of the uterus. It is employed in cases in which the uterus would go back in the pelvis, and with the ligament frayed out the fundus would drop back under the uterus. We had other measures advocated which tended to throw the body of the uterus backward. In these cases after operation Dr. Ochsner tells us, although this attachment of the uterus to the anterior abdominal wall is severed, the uterus does not want to go back in the pelvis where it was in the process of infection. It is surprising none of these cases have a predilection for retroversion.

I would say also, regarding the question of drainage in these cases, there is no question in my mind but what we can drain them successfully and not have them filled with adhesions. I feel I have solved the problem for myself, about the vaginal gauze drainage, in using paraffin stearin gauze. I recommended it to you last year. You will find this gauze will prevent adhesions; it is not a thing that becomes adherent and is oftentimes expelled spontaneously and unexpectedly by the patient often by bearing down pains, which shows it does not become attached, and general surgeons may use it to advantage in dressing raw surfaces.

Dr. John T. Moore, Houston, Texas.—This paper as well as the discussion has interested me immensely. I would like to

commend particularly Dr. Clark's suggestion of having an observation or rest ward, where these cases can be taken out of the hands of the surgeon temporarily, and set for operation if they need it. But as stated by one of the speakers, a large number of these cases will go without any operation and will be well; I say well, in the sense they are perfectly useful and good citizens and will have very little trouble. In our anxiety to get hold of these cases we sometimes do them a great injustice, and if someone who is not an operator, who is connected with the operating service, can handle them, I certainly believe they would be in safer hands.

He spoke of tubo-ovarian abscesses and the removal of one ovary and leaving one ovary or part of another. These cases have given me a great deal of consideration. Every now and then where I have left an ovary I have been compelled to go back and get it out, because it becomes either an abscessed ovary or a cystic ovary; and so I have been tempted several times, where I have had a tubo-ovarian abscess to deal with, to take the diseased ovaries out. I know that is not a good thing to do, as the effect upon the nervous system is bad. It has been our practice always to leave, if possible, one ovary. It has been my custom for a number of years to do what is known as a temporary ventrosuspension in these cases of pelvic infections, following the method of Dr. Kelly, and there is a difference between doing a suspension using the peritoneum, and in doing an operation that tends to more firmly fix the uterus to the abdominal structures as well as the peritoneum. If one has gone back into the abdomen for other conditions he has found in these temporary suspensions a small band of peritoneum sometimes lengthened out to a considerable extent. This ordinarily does not give any trouble. It may now and then strangulate the gut. If one studies these cases as he goes into the abdomen he will find nature has made use of two expedients to confine the abscess or infection to the pelvis. One of these is the rectosigmoid, and the other one is the omentum. It has been our practice, where the uterus is down in the pelvis, carefully to bring it up. I had the pleasure of seeing Dr. Cullen go over this subject and discussed it with him at some length at the time of the meeting of this Association in Baltimore. A very good expedient is to put in two rather large cigarette drains, or one if it is broadened

out, bringing the rectosigmoid around and very lightly attaching it to the posterior surface of the uterus. The cigarette drains are put in behind the uterus and out through the lower angle of the incisions. The omentum is brought down to the posterior surface of the uterus. We are not always sure the omentum will stay because it rambles around in the abdomen a great deal. The omentum will go to any infected point and try to take care of it. As there is a line of infection the omentum will attach itself where the sigmoid has been attached, and that leaves the small intestine free in behind the omentum and above the rectosigmoid.

Dr. R. S. Hill, Montgomery, Alabama.—I have been very much interested in this discussion. I think some of the gentlemen have been rather severe on Dr. DuBose. I rather suspect the doctor is not far away from the practice of the gentlemen who have criticized him. Undoubtedly his negro patients have been a little slow to come to operation, slower than his white patients, and though he has operated on them as soon as they came, their operations were not closer to the onset of the disease than were the operations on his white patients. So I rather suspect the doctor is more in line with the views of his critics than it would at first appear.

With reference to drainage, I am a very firm believer in drainage, but I rarely resort to abdominal drainage, or drainage through the abdominal incision. Whenever drainage is indicated, and I am one of those who believe that it is in the majority of cases of pelvic inflammation requiring operation, the drainage should be through the cul-de-sac into the vagina—a good iodoform gauze drainage.

In regard to attaching the fundus of the uterus to the abdominal wall, I think every patient should be a law unto herself. There are cases in which this should be done, and there are cases in which it should not be done. The surgeon must decide in each case whether it should or should not be done. One of the speakers spoke of bringing the omentum down and spreading it over the intestines in the pelvis. I am thoroughly in accord with him in this. It should be done in practically every case in which there is enough omentum to reach the pelvis. The omentum acts as the policeman of the abdominal cavity and naturally should be wherever there is trouble.

Dr. Richard A. Barr, Nashville, Tennessee.—It seems that the farther South we go the more we think of drainage, and just because I am from pretty far South myself, I want to say a word or two against it. As to pelvic drainage I have been perfectly amazed at what has been said about it. I thought we all began to abandon pelvic drainage fifteen or twenty years ago, and yet as prominent a gynecologist as Dr. Bovée spoke of pelvic drainage and without disapproval. If we drain the pelvis it is done strictly for a local purpose. In such cases we certainly would not be trying to drain the general peritoneum but just the local area in the pelvis. The worst thing that could happen in cases where we leave this local drainage out would be a local accumulation. If that occurs, why can we not then go in and dilate the cervix or open up the cul-de-sac and put in our drainage? Years ago I began putting off drainage in these cases until I saw some accumulation had occurred. I do not believe I have in the last fifteen years put in a drain in a case of pelvic infection at the time of operation. Packing is sometimes required to control oozing, but it is not put in for drainage purposes. I wait until there is something to drain. I watch these cases very carefully, of course; but it is rare indeed that an accumulation occurs which has to be evacuated.

Dr. James W. Henson, Richmond, Virginia.—There are several points I would like to discuss in connection with this subject, but on account of the limited time I find I cannot do so. I have listened very attentively and with great interest to everything that has been said, and I do want to emphasize the importance of not operating in pelvic cases until after the acute stage has passed. I have worked this out entirely by myself. My private cases are largely chronic ones and do not enter into consideration. I am on the surgical staff of a Municipal Hospital which is fairly large. More than 50 per cent. of the work is gynecologic, and I have a great deal to do in this line.

I will say in passing that when I became a member of the staff of this hospital, I operated on every case I got my hands on, thinking it best, and operated upon a great many acute cases, many of them dying, and those cases that happened to be chronic having recovered from the acute infection for several weeks, were getting well when operated upon. That taught me a lesson.

Another lesson I have thoroughly learned during these years is that too many cases are drained. The drain is a mechanical irritant, lowers the resistance of the tissues along its track and encourages suppuration. This prolongs the convalescence, to say the least, and if injudiciously handled in removal the track or tube of adhesions around the drain may be opened and infection get into the peritoneal cavity. Furthermore, the drain fosters adhesions. Each year I have used it less in the subacute and chronic operative cases. For the past two years in our pelvic cases, even two weeks after the subsidence of the fever and other symptoms, if I can get all oozing controlled, and I spend some time in doing this, I close up without any drain, and I can say to you positively that within those two years I have not lost a single case except one, and that patient died suddenly from what I think was pulmonary embolism, so far as I could determine. There were no pelvic or abdominal symptoms, and from the history death must have been due to pulmonary embolism.

Dr. Robins (closing the discussion).—I wish to make only a few remarks in closing the discussion. In the first place, as far as I am concerned and the majority of people I know about are concerned, the treatment of pelvic inflammation has been more or less standardized. But still I hear reports every now and then in which are made all sorts of claims, some contending that they do not operate on any case of inflammation, and it occurred to me that if I brought this subject before the Association for discussion we would have differences of opinion expressed if there were any, and I wanted to know what other people thought about it.

Referring to the question of drainage, I use a drain so seldom that the nurse sometimes forgets where they are when I call for one, but it does happen now and then that it is really necessary to drain, and then when this is necessary the technic I suggested I believe to be the best. I stated in my paper it was seldom necessary.

I want to say a word or two in reference to early gonorrheal cases. I did not go into this phase of the subject particularly because I did not want to make the paper too long. But I have had excellent results in early gonorrheal cases from the use of

vaccines. I do not know how general the use of these vaccines is, but I have seen these cases melt away, so to speak, under the use of a vaccine, and it is worth while trying where we want to preserve the tubes.

In preference to temporary suspension of the uterus, it is hardly necessary to talk about that, for if you will turn back to the transactions of this Association for 1908 you will find every point that has been mentioned here today gone over then, and so far as I am concerned it is settled. I feel confident temporary suspension of the uterus accomplishes its results, and in reference to what Dr. Bovée said, there is this point about it: The object of temporary suspension of the uterus is to prevent adherent retrodisplacement. Of course, we have many cases of retrodisplacement that are not pathologic, but adherent retrodisplacement is, and it is to do away with this that we use temporary suspension. Maybe the uterus does drop back in the pelvis; I don't know. It probably does in some cases. If it does not cause symptoms, it does not make any particular difference. My experience in operating for pelvic inflammation has been most satisfactory. I have not been able to agree with those who say these patients should not have been operated on, and I attribute the excellent results largely to the fact that I have resorted to temporary suspension.

A NEW OPERATION FOR SUSPENSION OF THE UTERUS

By F. G. DuBose, M.D.
Selma, Ala.

On account of the ultimate failure of other operations in a large percentage of cases of retroverted or prolapsed uterus coming under my care or observation, I am presenting one which has permanently held the uterus in the desired position in a large series of cases over a period of time sufficient apparently to determine its efficacy.

Technic. A linen or silk thread on a full-curved needle is carried through the broad ligament as a running stitch, close to and immediately underneath the round ligament, beginning at the internal abdominal ring, carried across the fundus of the uterus, under the peritoneal coat, passing underneath the opposite round ligament until the other internal ring is reached. The needle is unthreaded and a ligature carrier is passed through the aponeurosis of the rectus muscle about an inch from the abdominal incision, and on a level with the internal abdominal ring, through the musculature of the anterior abdominal wall until it emerges from the parietal peritoneum at the internal abdominal ring. The linen suture is threaded on this carrier and drawn through the abdominal wall.

The same technic is carried out on the opposite side. Then both ends of the thread are caught and the uterus pulled up to the desired position. Two hemostats are then applied to the thread, one on either side where it emerges from the aponeu-

rosis of the rectus muscle. The peritoneum is then closed, the aponeurosis of the rectus muscle sutured, and while the forceps are still in position the linen suspension thread is tied. The placing of the forceps here described prevents the drawing too tightly on the suspension suture, which would bring the uterus too far forward, and possibly so narrow the space between the uterus and abdominal wall as to result in hernia or obstruction. The hemostats are removed after the tieing of the suspension suture. The closure of the abdominal skin incision is then completed.

Comments. The operation described has given uniform satisfaction. It has been done more than fifty times without a failure in any instance to correct the retroverted uterus. It has also been used in the milder cases of prolapsus uteri with good results, in all of which cases, however, the repair of the injuries to the pelvic floor has been coincidentally done, and defects or injuries to the uterosacral ligaments corrected or repaired as indicated.

It disturbs the anatomy of the pelvic organs in a less degree than any of the other suspension operations. It takes the stress off the attenuated round ligaments and allows them to regain their tonicity, while securely holding the uterus in position. It neither fixes the uterus nor interferes with the normal range of uterine mobility in any way. It does not interfere with fecundity, and it is improbable that dystocia may result in the event of pregnancy following this operation. The area of suspension is equal to the area of support, and the point of support is not concentrated in any one peritoneal area, but is uniformly distributed, so that it is hard to conceive that any reflex nervous irritation could arise from it. There is no raw surface left to produce adhesions. The ultimate disposition of the linen thread is to be replaced by a fibrous ligamentary cord, due to fibro-blasts thrown into the meshes of the linen thread, which eventually disappears. It is recommended because of its simplicity and the ease of its performance after such other pelvic or abdominal surgery, as may be indicated, has been done.

CASES OPERATED FOR SUSPENSION OF THE UTERUS, FROM MARCH 1, 1919, TO NOVEMBER 30, 1919, BY DR. F. G. DUBOSE, AT VAUGHAN MEMORIAL HOSPITAL.

There were in this time one hundred and forty abdominal sections on women. Thirty had suspensions; twelve primarily operated for retroversion, and other surgery done coincidentally; one suspension exclusively done.

Case.	Date.	Operation.	Coincidental surgery.
1	May 1	Suspension	Appendectomy; perineorrhaphy.
2	17	"	Appendectomy; double salpingectomy.
3	17	"	Appendectomy of left tube, ½ left ovary and rt. ovary removed.
4	17	"	Appendectomy; left salpingectomy.
5	21	"	Appendectomy; double salpingectomy.
6	27	"	Appendectomy; double salpingectomy; part rt. ovary removed.
7	31	"	Appendectomy; double salpingectomy; rectocele; perineorrhaphy.
8	26	"	Appendectomy; double salpingectomy; perineorrhaphy.
9	July 7	"	Appendectomy.
10	9	"	Appendectomy.
11	30	"	Appendectomy; double salpingectomy.
12	Aug. 3	"	Appendectomy; left ovariotomy.
13	14	"	Appendectomy.
14	28	"	Appendectomy.
15	29	"	Appendectomy.
16	Sept. 3	"	Appendectomy; perineorrhaphy.
17	8	"	Appendectomy.
18	15	"	Appendectomy; left salpingectomy.
19	23	"	Appendectomy; double salpingectomy; rt. ovariotomy.
20	29	"	Appendectomy; left tube and ovary, ⅔ rt. tube removed.
21	Oct. 2	"	Appendectomy, left tube and ovary; adhesion to uterus.
22	4	"	

Case.	Date.	Operation.	Coincidental surgery.
23	Oct. 14	Suspension	Appendectomy; double salpingectomy; perineorrhaphy.
24	15	"	Appendectomy.
25	Nov. 8	"	Appendectomy; left tube and ovary removed.
26	8	"	Appendectomy; left tube and ovary removed.
27	20	"	Appendectomy; rt. ovary, trach. and perineorrhaphy.

CASES OPERATED FOR SUSPENSION OF THE UTERUS, MAY 1, 1919, TO NOVEMBER 30, 1919, BY DR. D. H. DOHERTY, AT BURWELL'S HOSPITAL.

In this service there were twenty-nine abdominal sections on women; of these nine had suspensions of the uterus by this method and additional surgery as noted. One only was operated primarily for retroversion.

Case.	Date.	Operation.	Coincidental surgery.
1	May 14	Suspension	Salpingectomy.
2	31	"	Appendectomy; salpingectomy; rt. ovary.
3	June 22	"	Appendectomy; double salpingectomy.
4	29	"	Appendectomy; double salpingectomy.
5	July 5	"	Appendectomy.
6	6	"	Appendectomy, left tube and ovary.
7	23	"	Appendectomy; double salpingectomy.
8	Sept. 21	"	Appendectomy; double salpingectomy.
9	Oct. 28	"	Appendectomy; double salpingectomy.

In 169 sections on women in six months there were 39 suspensions done in this consecutive series of cases; *i.e.*, over 23 per cent. of all cases in women coming for abdominal surgery had retroverted uteri; 14 operations were done primarily for retroversion, or over 12 per cent. of all cases admitted were for this condition primarily.

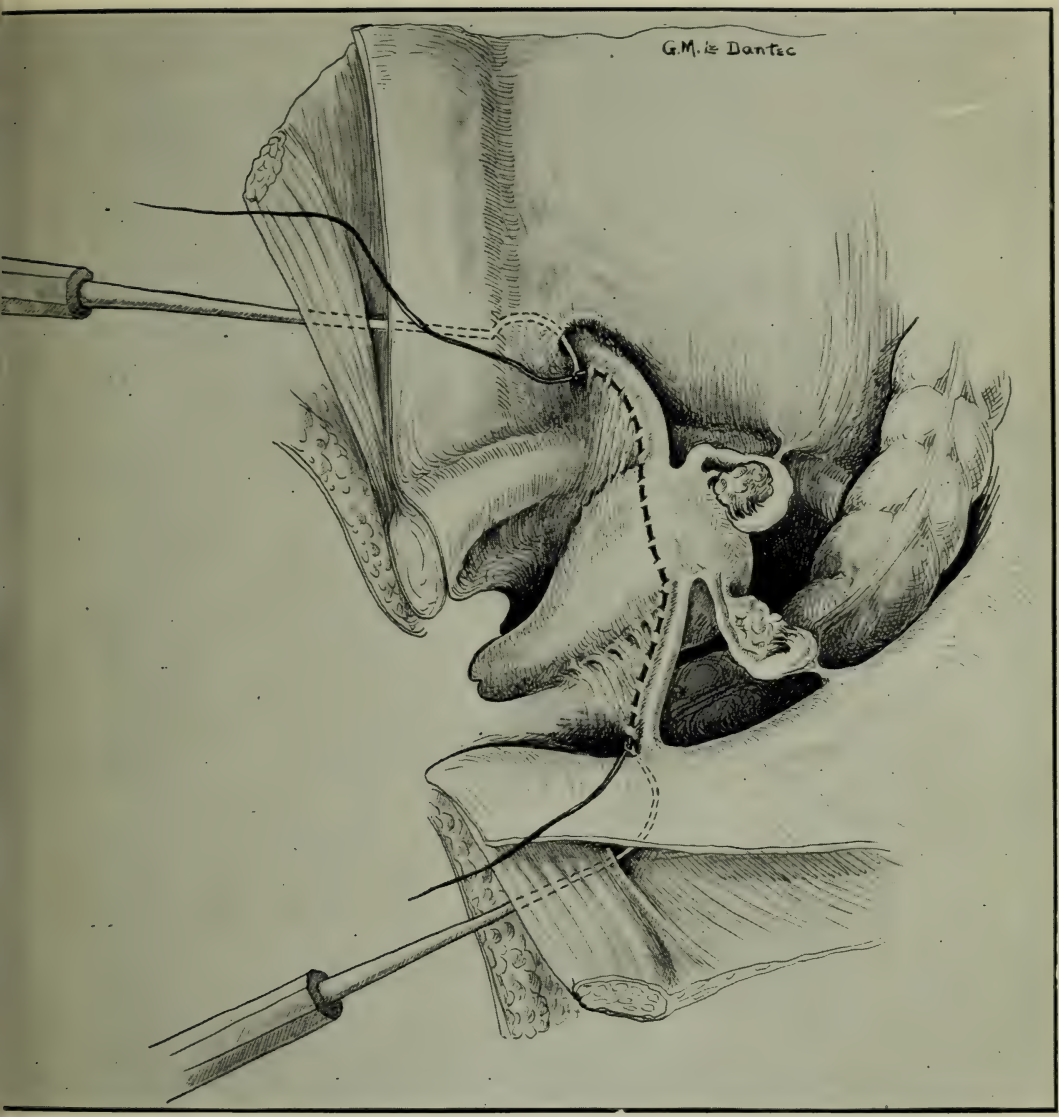

FIG. 1.—Diagrammatic drawing, showing insertion of suspensory silk or linen thread through abdominal wall, emerging at the opening of the internal ring, traversing broad ligament and fundus of the uterus.

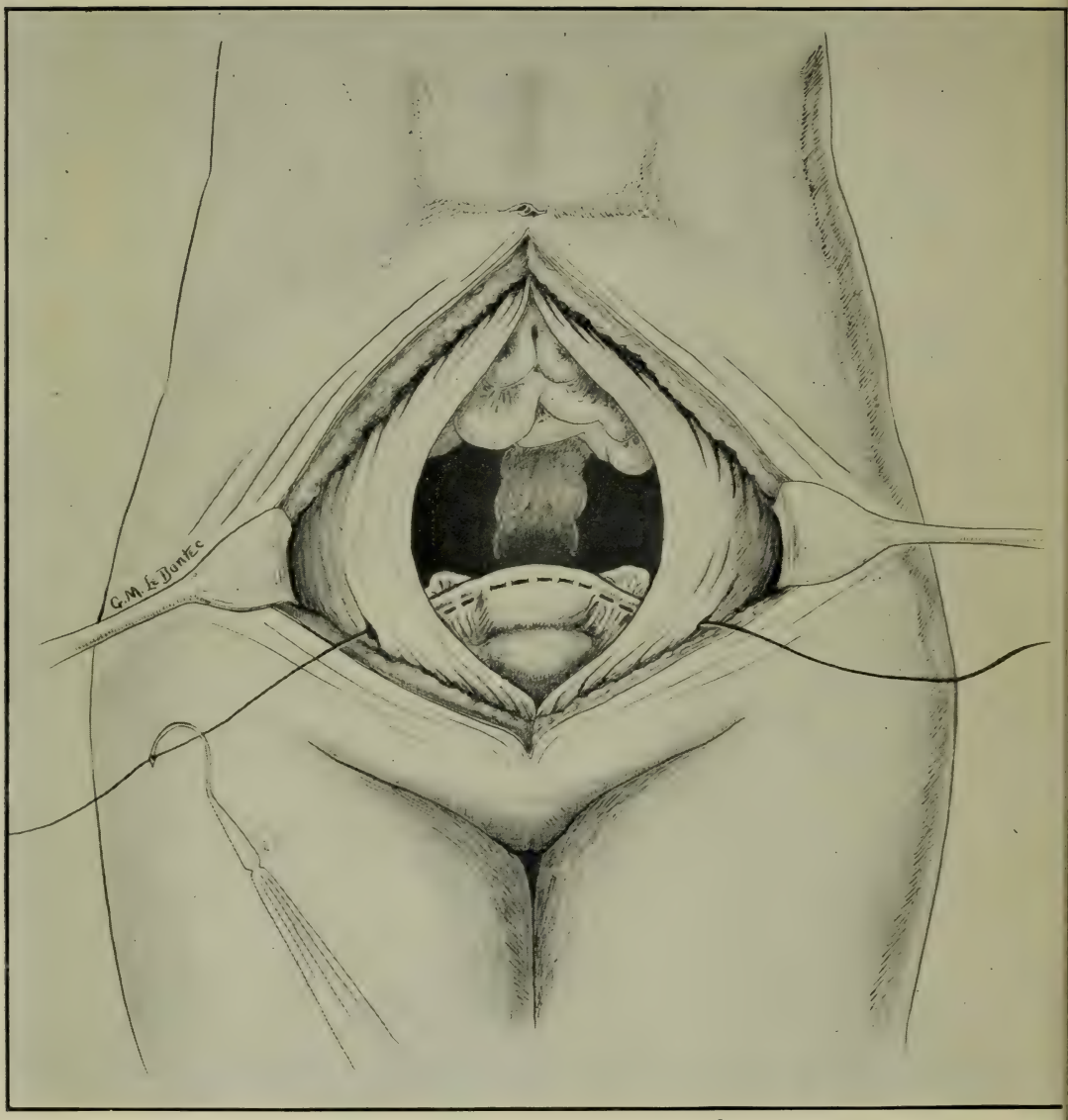

FIG. 2.—Insertion of linen suspensory thread as it appears at the completion of this stage of the operation.

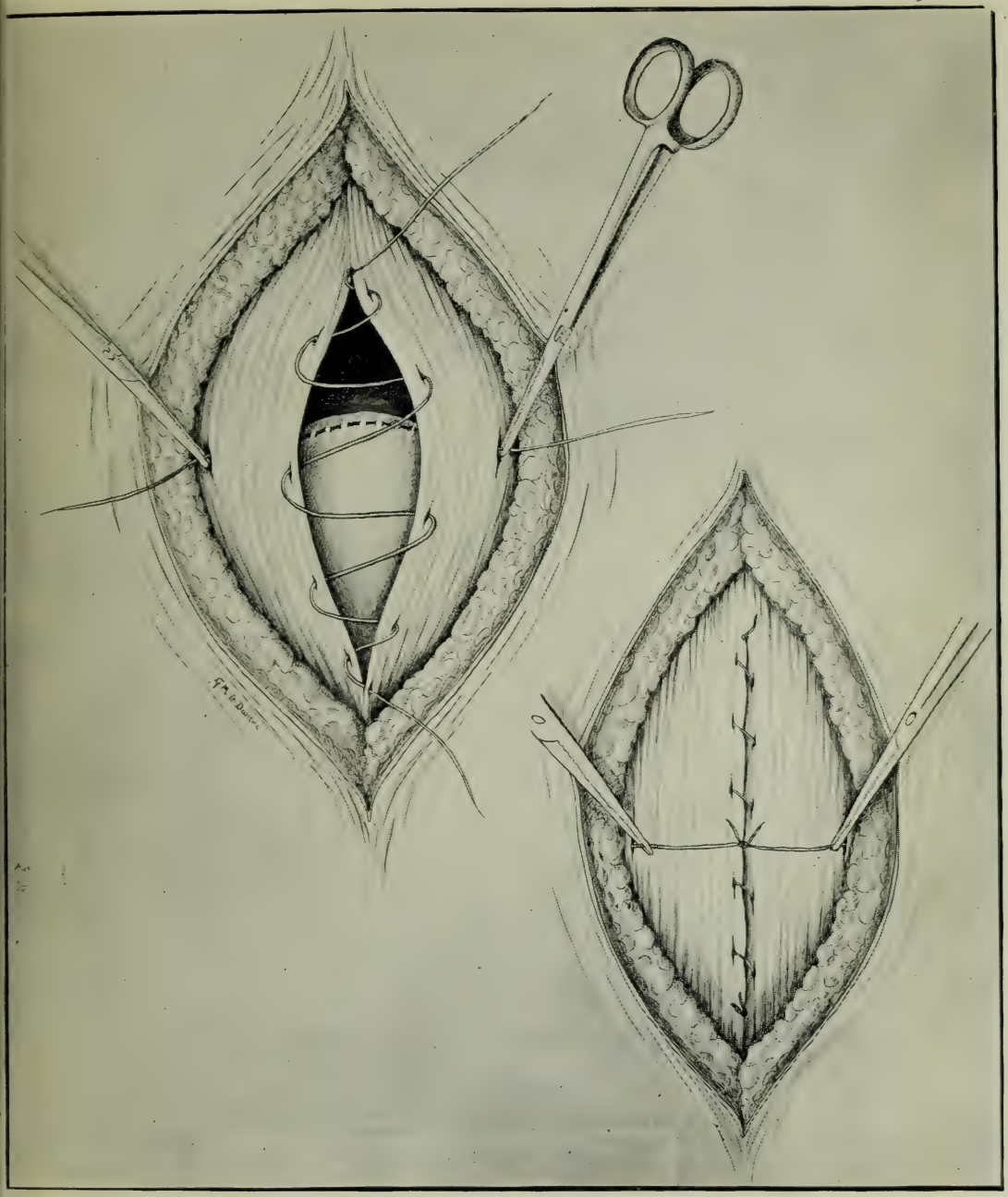

FIG. 3.—Showing application of forceps in upper insert and the suspensory thread holding uterus in desired position of anteversion. Lower insert shows linen thread tied after closure of abdominal incision.

DISCUSSION

Dr. John Wesley Long, Greensboro, North Carolina.—Dr. DuBose's paper, like so many things that have been said this morning, harks back to the ancient history of this Association. It brings up one of the old questions that we thought practically had been settled. I am much interested in Dr. DuBose's procedure for retroversion of the uterus. I think it is hardly time for us to criticize it because it is too new. I shall watch with interest his ultimate results, his morbidity as well as his his mortality, also the results in the hands of other men. The only criticism I would make of the operation, and it is not done in a hypercritical spirit, is that too much trauma is done. He does too much. It is unnecessary to have so much trauma in an operation to restore a retroverted uterus. Four years ago I showed a method of shortening the round ligaments before this body which I had been using for three years at that time, and which I have continued to use. It has been used by many other surgeons with much satisfaction. With your permission, I will throw a couple of slides on the screen which will illustrate more clearly and quickly the method than can be done in a few words. (Here Dr. Long showed slides illustrating his method of shortening the round ligaments.)

Dr. John T. Moore, Houston, Texas.—I have been very much interested in this subject and made a careful survey a number of years ago of the literature on the whole subject of suspensions and fixations, and as I remember Dr. Kelly told me there were about 150 different operations designed for this purpose. The fact that so many operations have been devised for this condition shows that no one method is entirely satisfactory, because if there was any satisfactory method we would stop trying to discover something that is better. The use of quinin in malarial fever is universal because it is satisfactory.

The operation described by Dr. DuBose resolves itself into a suspension operation by creating a band from one extremity of the ligature clear across the pelvis to the other side. That is the theory I will proceed upon. Wherever you put a needle through the peritoneum of the broad ligament, bring it out again,

and bring it in apposition to the parietal peritoneum, you get union of the peritoneal surfaces of the uterus and broad ligament to the peritoneum of the anterior abdominal wall, and as long as this linen ligature remains you will have it hold the uterus up, and when that gives way, there will be a lengthening out of the bands which have formed along the suture line.

It takes quite a little for the phagocytes to remove the linen. I think this is what he will find when he goes back into these cases. The operation I think may prove satisfactory in many cases, as nearly all of these operations have proved satisfactory in some of the cases.

The operation I had the temerity to present at the 1916 meeting of the Association I have done four or five times since then, and have gone over my cases, which number about 18 or 20, some of them having been done four years and probably five years, for procidentia, and they have all been relieved as far as one can tell from examination. The uterus is in good position, is freely movable, and the patients are happy and well, and I am sorry I did not have a plate to show. You may remember the fascial transplant.

The operation of Dr. Long I think is a good one, except it violates the principle laid down by Dr. Mayo a number of years ago, that he used a part of the round ligament in the treatment when the attenuated part is outside. That is the only criticism I have to make of that particular operation. The attenuated ligament is from the internal ring in its attachment to the pubes, and where you shorten the intra-abdominal ligament you lose the strong part of the ligament which ought to be brought up through the internal abdominal ring to make a proper suspension.

Dr. Isaac S. Stone, Washington, D. C.—I will only take the time of the association for a moment. I agree with my friend who has just spoken (Dr. Moore) that this field has been so thoroughly canvassed for so many years, that it is scarcely worth while again to discuss it, particularly regarding the mobility which involves the fixation of the fundus of the uterus. This is one of the clever methods. I do not see why it is better than Dr. Byford's or Dr. Long's, but it is working along the same line, doing the same thing to the fundus of the uterus. What I think is far more in need of study and improvement, to know

how to hold the cervix backward, to improve the methods of fixation of the cervix backward when we open the abdomen for retroversion. As Dr. Moore has just said, these ligaments are often defective. We often find the round ligament defective and a poor support; so we find the uterosacral ligaments defective, and the man who can give to the Association a method of holding back the cervix by some plan of securing it by the uterosacral ligaments or otherwise will deserve the thanks and gratitude of the Association.

Dr. R. S. Hill, Montgomery, Alabama.—This is an old topic and seemingly we are not agreed in our opinions as to the best method to be used for the relief of the condition.

Dr. DuBose's operation, it seems to me, presents several objections. First, if pregnancy should occur, and that suture has not been disposed of by nature, you will have trouble in the growth of the uterus or in delivery at full term. If the thread has been disposed of by nature, then the cicatrix, if it does not stretch will give trouble at confinement, and if it does stretch will lose its power to hold the uterus in position. It would also seem that the function of the bladder would be interfered with by the stitch. It certainly would be most desirable if we could shorten the uterosacral ligaments and hold the cervix of the uterus backward, but I have not been able to do this as successfully as Dr. Bovée. I have had to fall back on the round ligaments, and of the many operations utilizing these ligaments the one that appeals to me and has proved most satisfactory is Gilliam's.

When I first began to do this operation I was afraid of intestinal obstruction, and I undertook to add to the original Gilliam operation some modifications in closing the opening at the distal portion of the ligaments, but experience justified me, I believe, in abandoning these modifications. The round ligaments are pliable, soft and distensible, and, therefore, if the intestines should slip through the opening it will easily slip out. If pregnancy takes place, the round ligaments develop *pari passu* with the growth of the uterus, and after confinement they involute with the uterus and continue to perform the function of holding the organ in the forward position. I feel warranted in saying that this operation has afforded me more satisfaction than any other I have tried.

Dr. Willard Bartlett, St. Louis, Missouri.—A few recent failures in this direction have given rise to a thought or two that are philosophical rather than of a clinical nature. It seems to me, all our experience in hanging up portions of the human anatomy leads to the belief that almost any method of hanging up the uterus will do its work, provided there is not much need of it; that is, provided there is no definite pathologic reason for the retrodisplacement. Consequently, I use the simplest method I know of, putting the patient on the face for a few days and thereby assisting the intestines to drop in behind the body of the uterus, as Murphy pointed out, because the uterus will stay up if you have not fastened it at all. On the other hand, there are a few highly pathologic individuals in whom you may hang up the uterus as often as you want to and it will not stay. One of these individuals came to my notice a few days since, a young woman on whom I did a simple Baldy operation some years ago, and promised the customary relief from retention symptoms. She was relieved until the next obstruction, and her uterus was down where it belonged. She is a good friend of mine, and I jollied her along for five years, after which she demanded some relief. I opened her abdomen again, then did a real operation like you have been talking about. (Laughter.) I did a Gilliam operation. She had splendid ligaments, and I promised myself now that the uterus would stay. Just as I was closing the abdomen I looked down into her pelvis, and it occurred to me then why the uterus had not stayed in place. I found in pulling her uterus forward I was dragging upon a portion of the rectum intraperitoneally, putting a lot of tension on the round ligaments, because she had a pathologic attachment between the cervix behind and the anterior surface of the rectum. I could not get at them well enough to risk trying to separate these structures. That was the reason she had retrodisplacement which ought to have been corrected to cure her. That operation was done six months ago, and no doubt her uterus is back in the pelvis where it ought to be on account of her pathologic condition.

Dr. J. Wesley Bovée, Washington, D. C.—In my judgment, retroversion of the uterus *per se* requires no surgical procedure. In other words, no operation is justified. If we have complications, then we have to treat both the displacement and the com-

plications, and our remedy will be according to what the complications are. Most of the cases of backward displacement of the uterus, aside from pelvic infections are due to congenital conditions in the ligamentary attachments to the lower pole of the long axis of the uterus, and not to the upper pole. Therefore, I feel that those should be readjusted when faulty rather than treatment directed to the upper pole of the long axis of the uterus, and I think we will find in many of these cases using the round ligaments for ventrosuspension to the upper pole of the long axis of the uterus will prove later to be what Dr. Bartlett has pointed out in connection with his patient. I will say again, there is one important point which escape men in the treatment of displacement of the uterus, namely, that we should at all events maintain the cervix in the hollow of the sacrum. If we bear that in mind, we are never so liable to get a displacement of the uterus backward.

Dr. William T. Black, Memphis, Tennessee.—All operations for retroversion and retroflexion of the uterus have merit. A surgeon should not decide positively on any particular type of operation before operating, and then perform this special type of operation when some other type might serve the case better. Different types of operations should be decided by the operator after determining the exact pathology present.

The Gilliam operation, or a modified Gilliam, will hold the uterus up well, and so far as retaining the uterus in this position, is good as the previous speaker has said; but I have had one complete intestinal obstruction, and another partial obstruction, which were due to Gilliam operations performed by other operators. It has its disadvantages, which I am afraid of, and I believe that only a modified Gilliam should be performed. In retrodisplacement, where the uterus is small and firm, without much relaxation to the pelvic diaphragm, I have found the Baldy-Webster a splendid operation. Where we have the uterus somewhat enlarged and flabby, with a first or second degree prolapse, the Barrett operation serves a much more useful purpose.

The operation described by Dr. DuBose is rather ingenious and unique, and I believe it has a disadvantage, as suggested by Dr. Hill, if pregnancy should take place. As I understand

it he uses a permanent suture, which holds the uterus in place and I believe it holds it so firmly in place if pregnancy should take place, the woman would be compelled to abort or the uterus pull loose from the attachment. If she should happen to go on to full term, it might interfere with labor. Another objection which might occur would be atrophy of the uterus and connecting structures, being so firmly bound by this permanent suture so as to interfere with the physiological movements of these organs. These objections might not hold good in this type of operation, but at present I would be unwilling to accept same without further evidence to the contrary. Dr. DuBose deserves credit for bringing the subject before us.

Dr. S. M. D. Clark, New Orleans, La.—If the same thought that has been given to devising new schemes for suspending the uterus had been given to working out a plan to determine when does a uterus really need suspension, women would be better off. As Dr. Bovée says posterior displacements *per se* rarely give symptoms. About 40 per cent. of all women have displacements that are symptomless. Occasionally a non-complicated displacement will give symptoms and I have found the use of a Hodge-Smith pessary most valuable in differential diagnosis. Before the causes of backache were better understood, if one examined such a case and found a posterior displacement all symptoms would be at once attributed to this finding and a suspension performed. Reduce the uterus, introduce a pessary, and examine the case two days later. If the uterus is held in position upon the second examination and all symptoms are absent, then the pessary should be withdrawn and the case instructed to return in two days. If the uterus is in its old position and all symptoms have returned then it is justifiable to operate. This has helped me in determining those cases that need anything and if properly used will reduce the number of needless operations upon tilted uteri.

Dr. DuBose (closing the discussion).—From the trend of the discussion it seems that I have created the impression that I am looking for retroverted uteri on which to use this operation. (Laughter.) It is not the case at all. We had intestinal obstructions from the Gilliam operation; all sorts of pathologic results

followed Coffey's operation; all manner of complications followed ventrosuspension of the uterus, and as a sequence nervous women, we believe as a result of adhesions or recurrence of the retroversion. In the essay I did not go into the etiology or pathology, for the reason that I took it for granted nearly every surgeon doing anywhere from two hundred to three hundred abdominal sections on women in a year was called upon in a certain percentage of the cases to correct retroversion of the uterus because of symptoms produced by it. There is no question about the fact that symptoms are present as a rule. For some years a half dozen of these operations were tried in my hands and discarded, because in many cases they proved inefficient. Then some man suggested a technic that he had never used himself. It looked to him reasonable to stitch under the round ligament from the uterus to the internal ring a running suture, which caught the parietal fascia near the internal ring in a loop and was brought back and inserted into the uterus just at the attachment of the round ligament. When tied, acting like a purse-string on each side, it pulls the uterus up in the position desired. It was a good thing, better than most others; but with the disadvantage that it had two concentrated points on the parietal fascia for support of the uterus with a pull resulting in nervous symptoms. The point I tried to mention under comments and methods was this: wherever you have a single concentrated point of support on the peritoneum, or on any part of the abdominal parietes, anterior or posterior, you will get in a great many instances nervous or other painful abdominal symptoms, and that was the objection here. The thing in the operation devised and described in my paper that appeals to me is that not any of the natural supports of the uterus are used to hold it up. Particularly the fibromuscular round ligament is avoided, for in most cases it is so attentuated from stretching that you can plicate it and do everything with it you wish, and you have not succeeded in utilizing it as a support when you have finished. In this operation, the area of support and of suspension is equal. The very exceptional fact remains that only in this operation do you have an area of support and an area of suspension which is equal, and you have no concentrated points of attachment to be pulled upon.

Some of the men misunderstood the reading of my paper and

the drawings exhibited, in thinking that we suggested in this operation drawing the fundus of the uterus up against the abdominal wall. We do no such thing. The suture is put in through the rectus sheath on a level with the internal abdominal ring, the aim being to support the round ligament as nearly as possible, taking the stress off it and holding the uterus in its normal position. There being no concentrated area of support, it is hard to conceive how any nervous phenomena should follow. Unless the suture is driven deeply into the uterus, it is unconceivable how a suture running underneath the peritoneum of the fundus of the uterus can produce dystocia or any other condition interfering with delivery. And it should not interfere with pregnancy, because you have not narrowed the opening between the abdominal and pelvic cavity to such an extent.

Some men think the retroverted uterus in the pelvis is where it ought to be, because it does not produce symptoms. Yet if it does produce symptoms we should try to afford relief. As a rule, the retroverted uteri the surgeon sees are in those women who have symptoms. I have not operated on a symptomless case yet; I have not found them. I may not be as keen as some of the rest of observers.

I have not discussed the difference between the functions of the upper and lower supports of the uterus, as to whether one was greater than the other in maintaining the uterus in position. The only thing that I have had the temerity to offer is the operation I described, regardless of the role played by either the round or the uterosacral ligaments of the uterus, as neither of these ligaments are employed in the operation; the stress is simply taken off them. If their structural efficiency can be restored, they are given a chance; if not, a substitute has been made by the operation advised, which will hold the uterus in its normal position.

UNRAVELLING THE MYSTERIES OF RIGHT-SIDED ABDOMINAL PAIN IN THE FEMALE

By J. N. Baker, M.D.
Montgomery, Ala.

Unquestionably the most fertile field in the human body for mistaken diagnoses lies on the right side of the abdomen, extending from the last rib down to the pelvic outlet. This picture is at once rendered more complex in the female by reason of the fact that the important generative organs of this sex are buried within the peritoneal cavity as contrasted with their extraperitoneal location in the male. To make a diagnosis of an orchitis is simple and is likely to be correct; but the prudent surgeon should hesitate to dogmatically assert, upon his first examination and before a careful review of all the possibilities, that any given pain or symptom-complex was the result of an "ovaritis" or of "ovarian neuralgia."

The slow evolution and gradual unfolding of the diagnostic pitfalls which haunt this locality have been a theme of intense interest to many conscientious workers, who, after years of ceaseless toil and of broad clinical experience, sit down to carefully and properly evaluate their surgical endeavors by the relief—permanent and enduring—afforded the patient. Is it not upon such painstaking analysis as this that the ultimate fate of any surgical procedure undertaken for the relief of human suffering must rest? Measured by this standard very many of the surgical devices, even though fathered by men of note and ability, have failed to perpetuate themselves and have justly been relegated to the limbo of obsolete practices.

Both apology and explanation should be made by the surgeon who boldly rushes in to anchor the low and movable, yet innocent, kidney of the general visceroptotic; or by the surgeon who, after a cursory survey of the patient and discovery of tenderness in the right iliac fossa, and in defiance of a history of definite acute attack, proceeds to incriminate an inoffensive appendix for years of right-sided distress. The final outcome of such expedients can but be heart-rending alike to surgeon and patient, for they neither correct existing pathology nor bring the desired relief.

The knowledge which is now at the surgeon's disposal for the accurate determination of the various lesions likely to occur in this locality is ample and varied and is not the product of a single mind or of a single generation. The first ray of light was shed on this subject more than a century ago, when Ephraim McDowell did his first deliberate ovariotomy for ovarian cyst, thus proving that the female pelvis, while entitled to respectful consideration, yet could be assailed from without.

Then followed the "antiseptic era," inaugurated and perfected by Lord Lister, whose untiring efforts placed, for the first time, surgical technic upon a scientific and rational basis. A strict adherence to these antiseptic principles broadened the scope of general surgery and wrought marvellous change for the better in such operations as amputations, lithotomy and the like.

The peritoneal cavity, however, was still sacred ground, not to be trespassed upon save in the gravest emergency. In 1885 Reginald Fitz, of Boston, presented his classic paper on appendicitis, based largely on dead-house evidence. Four years later, in 1889, McBurney, of New York, deliberately attacked an accute appendix prior to abscess formation and this paved the way for the new era in abdominal surgery.

The battle is now on; the bold and intrepid surgeon quickly comes into his own; the right-sided pain—the constant companion of the average female—must be made to quickly vanish, being due, in his opinion, solely to one of two causes—either to a "chronic appendix" or to an "inflamed ovary." In case of

doubt, says he, remove both; as surely the easy approach to and their close juxtaposition warrant such a procedure.

Witness now the merciless slaughter of innocent appendices and the never-ending line of eternally sterile women because of their "scirrhous" ovaries, and yet with relief seldom lasting longer than the enforced recumbent posture might explain. Upon the return of the same old pain in the same old locality a different surgeon is consulted who finds that "adhesions" have formed at the site of the former operation, or perchance that a "loose kidney" is to be incriminated. Whereupon ensues more surgery; not so mutilating, perhaps, but quite as ineffectual, insofar as relief to the patient is concerned.

Necessity has been dubbed the mother of invention; whether this be true or no it was, nevertheless, at this stage in the development of our surgical knowledge that two agencies, destined to revolutionize and to reshape our former concepts of the pathology possible in this area, were given to the profession. One was the roentgen-ray and the other the cystoscope. So illuminating, so clarifying, so helpful have these agencies proved in the effort to properly and definitely solve the hidden tangles of this maze that no surgeon is longer justified in employing the "hit-or-miss" tactics so common a decade or so ago, and which, unfortunately, are even now all too frequently practised. Before sentence is passed incriminating any given organ all available evidence must be assembled and carefully weighed, which means that a study, possibly extending over a period of several days, and combining the efforts of as many special workers, will have to be made before proper and final judgment can be passed.

The first, and singly the most important, step in the effort to arrive at sound conclusions, is the history, carefully and sequentially recorded by the surgeon himself and going back to the very incipiency of the trouble; for, let it be recalled, we are now dealing primarily with chronicity. Careful search must be made in this long trail for acute "flare-ups," the proper interpretation of which will, oftentimes, serve as valuable guideposts. That is to say, was the acute condition, as

unfolded by the history, attributable to the appendix, to the tube or ovary, to a renal colic, to a pyelitis, to a ureteral stone or to stricture? A painstaking history seldom fails to reveal one or more exacerbations which point the way to the organ involved, whether digestive, urinary or reproductive.

One should always hesitate to hold responsible an appendix for chronic right-sided pain whose history does not unfold definite acute attacks; nor should too much importance be attached to the roentgen-ray findings of a distorted and stagnant appendix whose history fails to reveal either acuteness or reflex digestive disturbances. In some instances of chronic right-sided distress a sagging and ptotic condition of the right kidney, cecum and ascending colon would seem to satisfactorily explain the mischief. An eternal tug is exerted by a stagnant and weighty cecum which, in turn, tends to drag down the kidney overhead, thus producing morbid changes in the renal circulation and drainage. When such a picture exists the appendix should in no sense be considered as the causative factor even though it presents evidence of pathological change.

Or the reverse pathological condition may obtain: instead of a ptotic and dilated condition of the cecum one may encounter a maldescent or partial rotation of the cecum, which is bound down and otherwise distorted by bands, either congenital or acquired, or both. This gives the picture familiarly known as "Jackson's veil" or "Lane's kink." Here, also, the appendix may show inflammatory changes but cannot be held primarily responsible.

It is to this class of patients that most careful study should be given; the employment of both the roentgen-ray and the cystoscope is mandatory. If the genito-urinary tract can be shown to be pathology-free, then, and not until then, is one justified in making his attack upon the intestinal tract. The mere removal of an appendix neither suffices nor brings relief; this is evidenced by the host of sufferers still clamoring for help and who present neat scars over McBurney's point. Liberal incisions should be employed, a careful survey of the entire area made and all needed surgery applied.

The more one studies this large and interesting group the more convinced he becomes of the very important role played by pathological lesions of the urinary tract in the production of the symptom-complex presented. As the horizon of our knowledge broadens, fewer and fewer of these cases are consigned to the neurasthenic scrap-heap. The scrawny female, no less than the buxom lassie, may harbor real pathology if only care be taken to unravel it.

The truth is just beginning to be thrust home as to how frequently obstructive lesions in the ureter, with the concomitant damage done the kidney overhead, may be held accountable for just the train of symptoms now under discussion. Hunner, of Baltimore, to whom we owe much for his pioneer work on ureteral stricture, contends, and, I believe, fairly, that this lesion is one of the commonest causes of abdominal symptoms in the female; and, further, that unrecognized ureteral stricture provokes more needless and fruitless surgery than any other pathological lesion.

The symptoms manifested by this malady, while at times prodigiously protean, yet, on the whole, are fairly typical and constant. The pain is variable both as to severity and location; centering, most often, at the site of the ureteral inflammation, whence it sprangles out, either up or down or laterally. One of the most frequent complaints elicited is a dull, boring pain through the hip and pelvic bone. One patient recently seen, and who had a marked stricture with a pelvis dilated to 30 c.c., had been treated for arthritis of the right hip-joint as well as having had the appendix and right tube and ovary removed and the kidney anchored.

The character of the pain resulting from a strictured condition of the ureter varies from the agonizing and intolerable pain of a stone to the growling and easily bearable pain of a sore tooth. The discomfort and the tenderness are practically always accentuated by the menstrual engorgement, and, as most ureteral strictures are located in the lower or broad ligament area (about 90 per cent. are to be found in the last three inches of the ureter), the frequent error made of mistaking the

lesion for one of the ovary or tube is scarce to be wondered at. Undue exertion or excessive physical fatigue are likewise prone to magnify the discomfort or even to precipitate an acute exacerbation indistinguishable from that of a ureteral stone. As the lesion progresses obstructive symptoms are likely, sooner or later, to supervene, with a resultant hydronephrosis or pyelitis and an almost constant and persistent loin pain.

It is interesting to contrast the radiation of pain in ureteral lesions with that of a chronic appendix; in the latter case, radiations, if present at all, will likely be upward and inward toward the navel or solar plexus; whereas in the former the radiation will be upward and outward toward the loin or else downward and inward toward the bladder. This behavior is readily explained by the nerve supply of each.

The site of maximum tenderness in ureteral lesions is most often located to the inner side of McBurney's point where the ureter passes over the pelvic brim and corresponds neither to the appendix nor to the tubal tenderness.

The urinary findings may be helpful or grossly misleading by reason of their negative character. If the patient is experiencing an acute attack, sufficient morphology may be, and usually is, found in the urine to guide one aright; if the condition be quiescent the urine may be entirely negative and hence deceptive. Hunner, in a series of cases recently studied, found a normal urine in 75 per cent.; he, however, stresses the importance of the appearance of a few scattered erythrocytes or leukocytes in the catheterized specimen, as these are elements which a normal urine should not present. Therefore, one negative urine, reported routinely from the laboratory, does not justify the assumption that the urinary tract is blameless.

Likewise the cystoscopic findings, insofar as giving definite evidence of a lesion overhead, may or may not prove helpful. If the stricture be located in the broad ligament region and is of long standing, and, more particularly, if pyelitis has existed or is present at the time of examination, quite marked changes may be noted both at the ureteral orifice, and, indeed, over the whole trigonal area. The orifice, instead of being a mere slit,

as normally seen, may show considerable edema, pouting and redness and the entire base of the bladder may present striking evidence of congestion. Such a picture will at once arouse suspicion of a possible lesion in the tract above.

A well-taken history; a carefully made urinalysis of the catheterized specimen of urine; a close scrutiny of the interior of the bladder by cystoscopic examination; the exclusion of stone formation and of intestinal tract lesions by means of the roentgen-ray, these are all most helpful adjuncts, and, in combination, may afford strong presumptive evidence of the presence of a ureteral stricture. Yet the evidence thus far obtained is not absolute. To be sure one must feel the obstruction. Anyone who has passed an acorn-tipped bougie into a strictured male urethra can recall and appreciate the definite sense of resistance and hang imparted by the stricture upon removal of the bougie.

For diagnostic purposes of strictured conditions of the female ureter, as well as for their treatment, the same condition is reproduced. By implanting upon the renal catheter a spindle-shaped wax bulb and by the employment of the Kelly cystoscope one can readily determine the presence or absence of stricture. The diagnostic test rests upon the information gained by the withdrawal of the catheter thus armed. If no obstruction exists the bulb will travel the entire course of the ureter without pain to the patient and without hang. If obstruction does exist both the pain and the hang are imparted, the patient frequently remarking upon the similarity of the pain thus produced to her old suffering.

Within so short a compass one cannot further dwell upon the details of technic in this procedure. It is not particularly difficult, though for rapid execution it demands practice. Yet for the conscientious surgeon, seeking more light and better results, to have definitely determined the presence or absence of ureteral stricture in any vague abdominal case will be a most valuable aid in correctly unravelling this perplexing tangle.

DISCUSSION

Dr. Guy Leroy Hunner, Baltimore, Maryland.—It is very gratifying always for one to have his child recognized and praised. I was thinking, while listening to Dr. Baker's clear, logical and eloquent paper, that perhaps if I could write as good a paper my child would have been recognized long ago. It is particularly gratifying to have members of this Association as well as other surgeons throughout the south, take up this question and get the same results that I have been getting for a number of years.

Many of you will remember I first read a paper on "Chronic Ureteritis and Chronic Urethritis; due to Tonsillitis," at our Louisville meeting about nine years ago. It was several years after that before I began to realize the importance of this subject, and it has only been in the last four years that I have been preaching the subject in season and out of season, realizing as I had not done before, how much suffering is caused by ureteral stricture, and how important it is for patients that we have a more definite recognition of this lesion. Men like Neff of Charlottesville, Shallenberger of Atlanta, Watkins, Turlington, Dabney, and several other men in Birmingham, and Folsom of Dallas, are very active in this work and are obtaining the same results that I have observed.

I wish to emphasize the point that Dr. Baker brought out so well in his paper, and wish I could put it as graphically as he has done, so as to help you to grasp the idea a little better. I refer to the point as to the location of the pain in ureteral stricture. Dr. Baker has told us that the pain in a case of ureteral stricture is usually medianward from McBurney's point. The ureteral pain is found about half way between McBurney's point and the umbilicus. In the appendix case the pain is usually at McBurney's point or outside. Another point in favor of the pain being ureteral is to find pain over the ureteral region on the opposite side, the stricture being so often bilateral, sometimes running for several years with symptoms only on one side, and no symptoms on the other, although on investigation we find stricture is present on both sides. If you ask the patient to show you where the pain is, she will almost invariably put her fingers down back of Poupart's ligament deep in the abdo-

men, and, if you press in deeply above Poupart's ligament rather than place the hand over the appendix region, you will be able to locate the seat of the pain.

Dr. William S. Baer, Baltimore, Maryland.—I have been very much interested in listening to the paper of Dr. Baker and I want to make the plea that all pain in the right side of the pelvis does not come from the inside of the abdominal cavity or pelvis itself. One of the most common causes of pain is a simple strain, and one of the joints that is more subject to strain than any other joint is the sacro-iliac synchondrosis. It has the normal amount of motion probably during pregnancy and becomes very much strained at that time. I have seen many ovaries removed and many chronic appendices removed which have not relieved the symptoms, but after the proper treatment was given to the sacro-iliac joint the symptoms mentioned here this morning began to disappear. The symptom of definite sacro-iliac strain is pain on the posterior part of the sacro-iliac joint, but especially pain in front of the abdomen, which is confused with pain particularly at McBurney's point. The pain is not at McBurney's point, but is situated one inch to one side and just below the umbilicus. That pain is constant in sacro-iliac strain. I have never seen it fail when pressure was made directly at that point that pain was not elicited. Of course, there are several signs with sacro-iliac joint pain, namely, diminution of the lumbar lordosis and deviation of the spine always to the opposite side from the joint involved. If I had right-sided sacro-iliac pain or symptoms of it, the end of my spine would be deviated to the left side and not to the right. We also have Kernig's sign. I want to urge that in doing abdominal surgery probably there is no part of the body, besides the abdomen, which may give symptoms and cause trouble more than the sacro-iliac joint.

STONE IN THE KIDNEY

By C. H. Mayo, M.D.
Rochester, Minn.

In medical progress the means of relief by therapeutic measures or surgery have far outstripped our knowledge of the cause of disease. The etiology had been proved in a sufficient number of incidents, however, and reasoning by analogy in other diseases has led to measures of prevention and control of many of the common ailments before the identity of the bacterial agents was known. Medicine is in its most interesting phase, namely, a consideration of the etiology which carries investigation into the field of biochemistry, the newer physiology, and like sciences. The philosophic view of bacteria is to consider them necessary to life as the minute chemists of the air, the water, and the soil. But few of their countless numbers are the cause of disease by being misplaced in their activity and only a small number, possibly, are natural disease-creating organisms.

The Formation of Stones in the Kidney. Crystalloids probably form in the structure of the kidney, the cortex, and the surface, without local infection, the result of a rare unbalanced contest constantly ensuing between crystalloids and colloids. Stones in the kidney, ureter, or bladder undoubtedly originate in the kidney, except those which develop from foreign bodies in the bladder. The cause of stone in the kidney has long been a subject of discussion; the old and simple theory that they grew, like Topsy, is no longer satisfactory, and some of the other theories that have been advanced, although most interesting, are not generally accepted. An acceptable scheme of stone formation must be applicable to the several regions in which stones are found and it must not differ materially for any locality. Morris considers two types of stone, the first due to urinary salts or ingredients precipitated from the urine in the kidney, independent of any change in that structure or of

infection, and the second, to precipitation due to chemical changes caused by microörganisms. An analysis of stones in the Hunterian Museum has shown a urate nucleus in stones formed in infancy, a uric acid nucleus in stones removed from young adults, and an oxalate nucleus in stones removed from patients in middle life.

Two-thirds of the kidney stones giving trouble are found in patients in the third and fourth decades, although the stones appear in every decade of life. Certain observers hold to the theory that a slowing of the delivery of urine in limited areas leads to increased concentration and deposit of salts. In denying the infection theory they call attention to the fact that renal stones are more often found in men than in women, although the female genito-urinary tract is more likely to be infected. According to their theory, therefore, an increased number of stones should form following mechanical interferences in areas of the pelvis with the passing of urine, such as partial ureteral obstruction, and extraneous pressure from glands, tumors, or pregnancy, for instance; but this does not appear to be the case. Hunner's theory is not generally accepted, that the over-saturated urine forms stones which originate in the ureter above a stricture of large caliber and may float back into the pelvis of the kidney. It is barely possible that the infection causing stricture may be furnishing mucoid, the cause of stone formation in such a condition. If these hypotheses were true, the number of cases of stone from such causes would be greatly added to by the partial compression of anomalous vessels acting on the ureteropelvic juncture in unusual mobility of the kidney, first shown by W. J. Mayo and later by Rupert to be a very common condition.

Stones are frequently found in both kidneys. Braasch found bilateral lithiasis in 12.3 per cent. of 450 cases of nephrolithiasis. Many patients with stone in the kidney have no pain, and 65 per cent. with stones in both kidneys have pain on one side only. Cabot, by means of repeated tests, showed that there are no abnormal urinary findings in 14 per cent. of the cases of stones in the kidney and ureter. The kidney is an organ of filtration and is constantly eliminating bacteria from the circulation. These are many in variety and, without some con-

tributing circumstances, apparently do not injure the urinary tract in their passage through the kidney, ureter, and bladder any more than bacteria on the skin or those passing through the alimentary tract or normally living there cause trouble in those regions. Some types of bacteria produce infarctions in minute clumps of capillaries, and following surgical conditions gross kidney infarctions and infection which cause death are occasionally seen. The minute hematogenous infections at the boundary of the terminal circulation in the cortex of the kidney at its juncture with the tubules are seldom extensive enough to create more of a change in the patient's general health than an acne pustule on the face. The eliminating surface of the kidneys probably equals that of the skin covering the body, but the latter has the power of cell growth given to epithelium for restoration as an additional protection. The infection theory seems the only tenable one, but I contend that the development of stone requires the presence of two factors of infection, that is, two types of bacteria, one producing the hematogenous infection, and one only coming from a local focus; the second may but temporarily inhabit the blood in the process of elimination. Bacteria of the stone-forming type must come in contact with the proper time, a brief period only, in which the mucoid exudate is present as a result of the first infection.

It seems hardly possible that the lime content of food or drink, which it must be admitted varies greatly, has very much to do with the origin of stone, although it might influence the rapidity of the growth of the stone. The origin of stone in the kidney is no more mysterious than that of stone on the teeth of infected mouths, which requires a chisel and hammer for removal; saliva resembles the mucoid, giving foothold through diseased gums for types of bacteria of the proper strain and stone formation ensues; this is true also in the development of gall-stones, which form only in an infected gall-bladder. A step further is the development of the shells of the fresh and salt water mollusks. We think of them as having been built by the mollusk; in reality they are built by bacteria feeding on the pabulum of his exuded mucoid material, accord-

FIG. 1.—Infected hydronephrosis with multiple nephrolithiasis.

Fig. 2.—Hydronephrosis with oval stone.

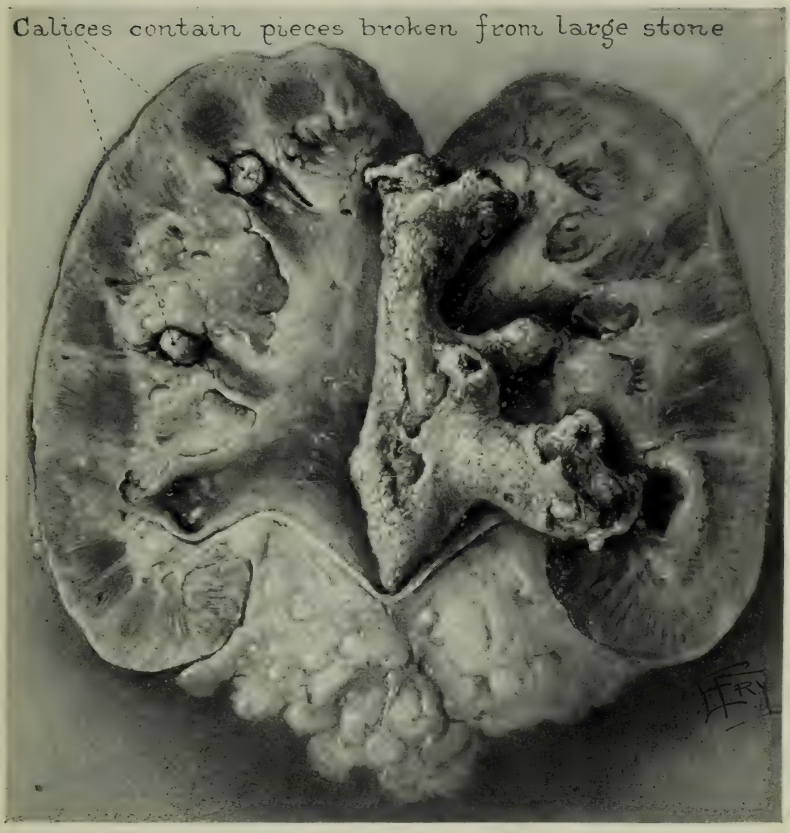

FIG. 3.—Coral-shaped stone with hydronephrosis of the kidney.

ing to which the natural type of shell is constructed from the solutions held in the water of the sea or river, the bacteria doing the work for bed and board, the mollusk furnishing the muscle hinge. If these bacteria become misplaced within his body a pearl or slug develops as the result of his disease. Such life can be reproduced only in limited areas of sea or river beds where the bacteria grow in great numbers, producing clam and oyster beds. The work done by such bacteria is no more important than that of the insects which fertilize the fruit flowers.

Stones form in the cortex, in the calices, and in the pelvis of the kidney. The kidney is constantly eliminating living bacteria, so that it is always exposed to infection, and usually shows no results from it except gross lesions of rare occurrence. Stone formation may proceed with exceeding slowness, and without pain or other symptoms until marked destruction of the kidney occurs, mixed infection develops, or until the stone assumes great size or becomes loosened and moves into the ureter (Fig. 1). Minute infarctions occur, as shown at necropsy following death from an acute attack, and the results of similar lesions in the past are shown by scars or gross kidney change.

Stone formation is evidently the result of the combination of two types of bacteria; the first creates an infarction with minute necrosis causing mucoid exudate forms; the second factor is the elimination at the same time of the stone-forming bacteria that they may come in contact with the mucoid material. If the stone originates in the cortex of the kidney its growth will be slow, but if it originates in the calices or pelvis growth may be much more rapid because of the ease with which its chemical material is secured.

Stones in the kidney vary in chemical composition but are homogeneous; they are round, irregular, multiple or branched, coral-like (Figs. 2 and 3). Those forming or increasing in the urinary bladder often form rings of varying widths, as shown by cross-section. During growth stones are covered with mucus, and the changes in structure probably have to do with the mucoid material on the stone or changes in the metabolic process, so that the structure varies with the changes in the number of the workmen or the material supplied them. Bac-

terial types differ in their handling of material as much as masons differ in the use of brick, stone and cement. It is of interest to note that young oysters transplanted from the shores of England to the Mediterranean oyster beds will have the ray shells formed by the new bacterial architects,[10] a fact of importance in considering branched coral-like stones in the kidney. Medical treatment in principle is based on a change in the chemical conditions of urine or local environment created by food changes, by dilutions, or by elimination of various chemical bacterial detritus. In the review of a limited number of cases in which operation was done during the formative period of surgery of the kidney Cabot found that stone in the kidney reformed in 49 per cent., and stone in the ureter in 29 per cent. Braasch in a consideration of 450 cases of stone in the kidney, in which operation was performed showed that the recurrence was slightly under 10 per cent. We believe that this better result is due to more careful examinations made within the last few years, to the greater facilities for all kinds of tests, including roentgenography, especially after operation, in order to discover whether or not a stone has been overlooked; the roentgenogram occasionally shows surprising results in cases of small multiple stones. More careful search must be made for extra stones since superimposed stones may give but one shadow.

The mortality is low in operations for the removal of stone in the kidney. The reports from the clinic (Table I) show that the mortality percentage has risen during the past three years over that of the years from January 1, 1898, to December 31, 1915; this is no doubt due to the greater risks which have been taken, but which have resulted in the saving of an increased number of lives.

TABLE I.—RESULTS OF THE REMOVAL OF STONES FROM THE KIDNEY.

	Number of patients.	Number of operations.	Deaths.
Jan. 1, 1898, to Dec. 31, 1915	450	484	3 (0.62 per cent.)
Jan. 1, 1916, to Dec. 1, 1919	487	499	8 (1.6 ")
	937	983	11 (1.12 ")

In closing, I wish to call attention to a plan devised by Braasch and Carman of the clinic to prevent overlooking stones in the kidney at operation and to facilitate search for small stones giving symptoms that are difficult to locate in the pelvis, the calyx, or the cortex of the kidney. In the course of the operation the kidney is elevated into the incision, above the level of the skin if possible, where it is held by an encircling pack of gauze; a portable roentgen-ray apparatus of the army type is moved to the side of the operating table and under the darkened glass and hood the roentgenologist is at once enabled to locate the stone and to point out the location with an aseptic glass rod, or, what is just as important, and occasionally occurs, he proves that the shadow seen in the roentgenogram was not due to stone in the kidney, and thus prevents serious injury to the organ by a fruitless search. The roentgenologist wears darkened glasses for fifteen minutes before attempting such an inspection. The operating room is darkened and the operator works under electric light which can be turned off and on.

Bibliography

1. Braasch, W. F.: Lithiasis with Bilateral and Renal Involvement. Boston Med. and Surg. Jour., 1918, clxxviii, 292–298.

2. Braasch, W. F. and Carman, R. D.: Renal Fluoroscopy at the Operating Table. Jour. Am. Med. Assn., 1919, lxxii, 1751–1752.

3. Cabot, H.: Errors in Diagnosis of Renal and Ureteral Calculus. Tr. Am. Assn. Genito-Urinary Surgeons, 1915, x, 258–264.

4. Cabot, H. and Crabtree, E. G.: Frequency of Recurrence of Stone in Kidney after Operation. Surg., Gynec. and Obst., 1915, xxi, 223–225.

5. Hunner, G. L.: The Etiology of Ureteral Calculus. Surg., Gynec. and Obst., 1918, xxvii, 252–270.

6. Mayo, W. J., Braasch, W. F. and MacCarty, W. C.: Relation of Anomalous Renal Bloodvessels to Hydronephrosis. Jour. Am. Med. Assn., 1909, lii, 1383–1388.

7. Morris, H.: Surgical Diseases of the Kidneys and Ureter. New York. Cassell, 1901, ii, 70–74.

8. Rupert, R. R.: Irregular Kidney Vessels Found in Fifty Cadavers. Surg., Gynec. and Obst., 1913, xvii, 580–585.

9. Rupert, R. R.: Further Study of Irregular Kidney Vessels as Found in One Hundred Eighteen Cadavers. Surg., Gynec. and Obst., 1915, xxi, 471–480.

10. Turnbull, A.: The Life of Matter. London, Williams & Norgate, 1919, p. 82.

RESULTS OF OPERATIONS FOR THE REMOVAL OF STONES FROM THE URETER

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Within the past few years many ingenious non-surgical methods for the removal of stones from the ureter have been devised and described, thus greatly reducing the need for operation in these cases. It is first to be desired in cases of stone in the ureter that the stone shall pass voluntarily into the bladder. In some instances this will occur during the first attack of pain, although usually several attacks are required to force the calculus through. Without special investigation of this subject it may not be realized how many persons pass stones spontaneously. I have known of 12 per cent. of a group of about 400 persons to respond in the affirmative when they were questioned with regard to the passing of stones.

The published data and our own experience seem to show that most of these calculi originate in the calices and in the kidney pelvis. In some of the cases in which there is an associated stricture of the ureter the stone may originate at the point of the stricture, as suggested by Rovsing and Hunner; in most of our cases, however, in which a definite, firm stricture was found there was no evidence of a calculus.

The symptoms produced by ureteral calculi are usually very definite and suggest the condition, even though in a number of cases the stone may lie in the ureter for a long time without any apparent changes or symptoms. In several such cases we have not seen changes of any consequence in the ureter or the kidney, nor evidence of interference with the passage of urine.

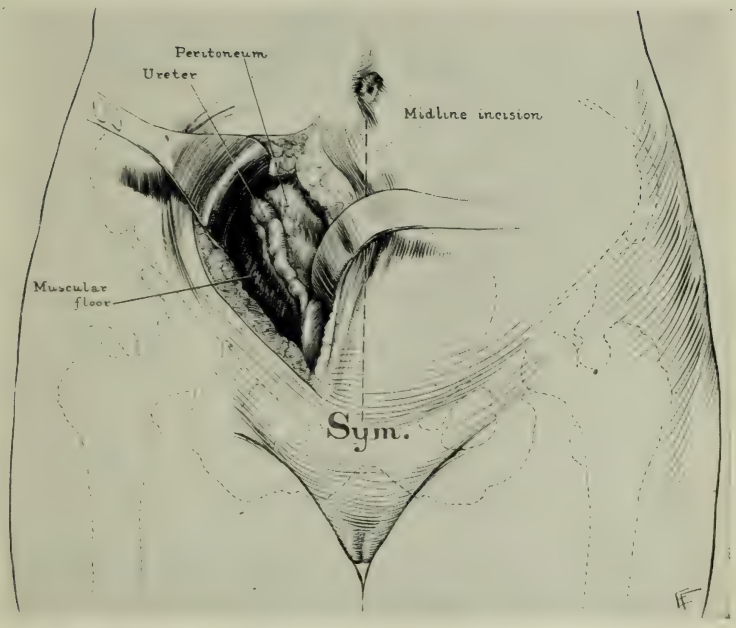

FIG. 1.—The midline incision is used when it is necessary to explore both ureters.

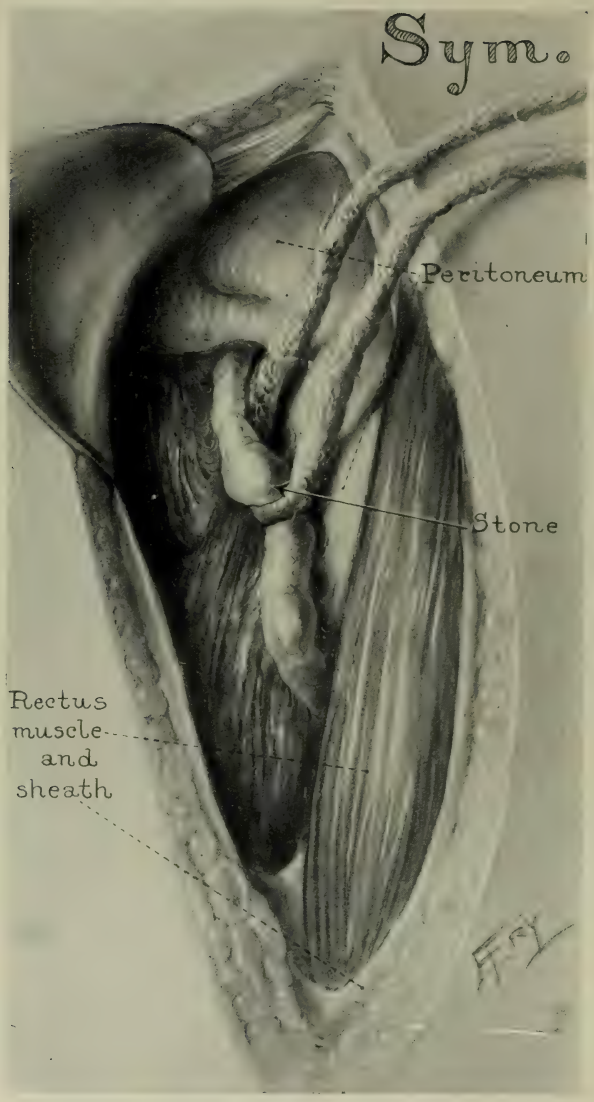

FIG. 2.—Isolated ureter containing a stone.

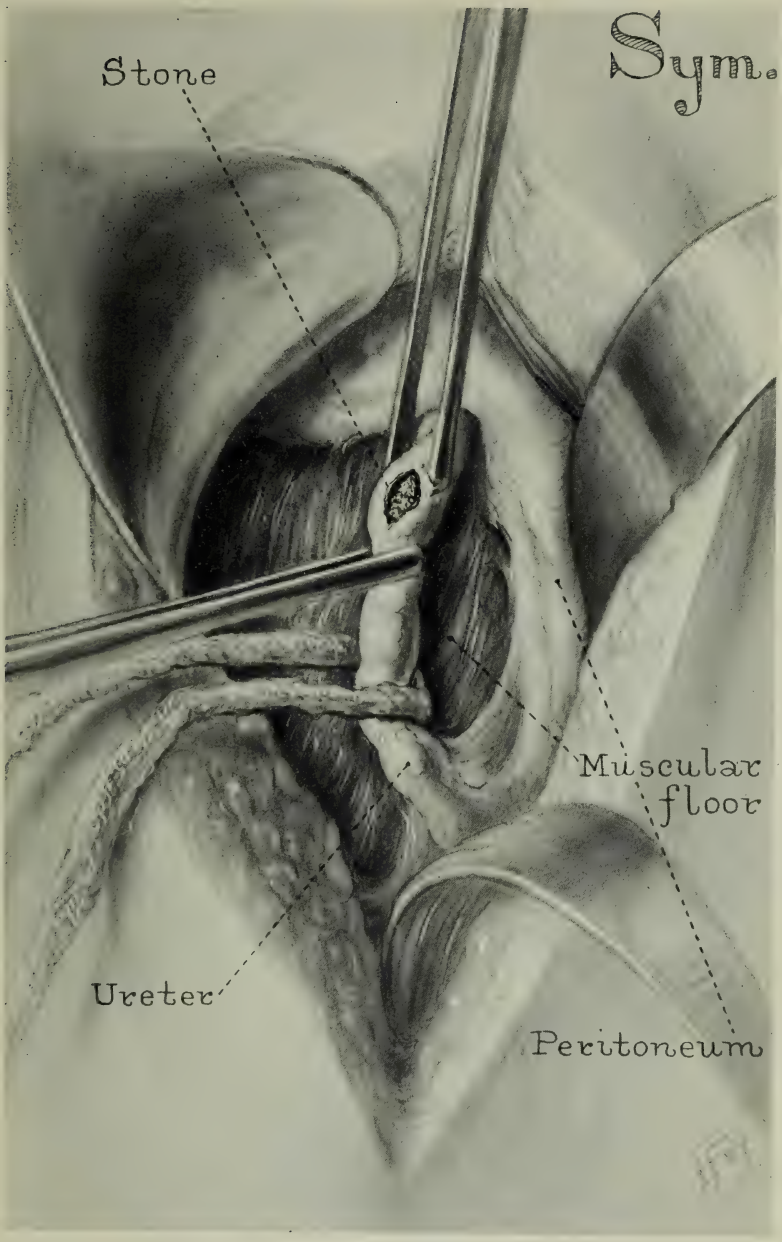

FIG. 3.—Incision in ureter showing a stone.

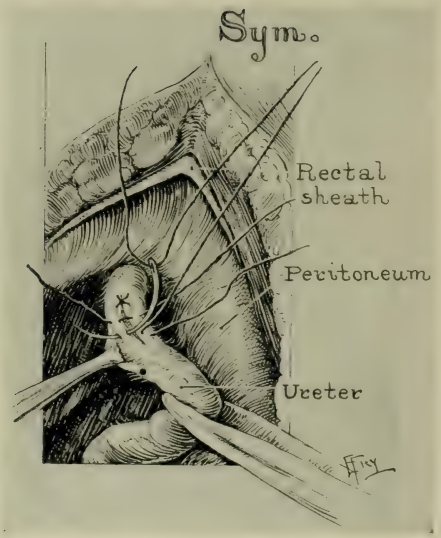

Fig. 4.—Interrupted catgut sutures being placed to close incision in ureter. Sutures do not pass through mucosa.

In by far the larger number of cases the characteristic symptoms are manifest, but the syndrome must not be depended on for the diagnosis, since it may be misleading; a variety of other conditions may produce nearly the same syndrome and, furthermore, an accurate and dependable diagnosis can be made in nearly every case by the use of the roentgen-ray combined with the opaque catheter and ureterogram, and in some cases the wax-tip catheter. In doubtful cases in which it is necessary to exclude the possibility of the roentgen-ray shadow which is being produced by an extra-ureteral structure, Braasch employes ureterograms, and by this method has reduced the possibility of error to an inconsiderable degree.

When the diagnosis has been made and the exact location of the stone is determined there are several points to be considered regarding the plan to follow. We must first remember that in many cases the stones will pass of their own accord, so that if the patient is having frequent and severe attacks of pain it will probably be best to keep him under observation for a reasonable length of time in the hope that the stone may pass unassisted. During this waiting period, however, the possibility of too severe pressure in the ureter and kidney and of a permanent hydronephrosis or pyelonephrosis should constantly be kept in mind in order that this waiting time shall not be too prolonged. In cases in which the stone apparently is not causing symptoms, even when it is discovered in the course of a routine examination, its removal is advisable unless there is some contra-indication. In all the cases in which the stone does not pass readily of its own accord it is best to consider the non-operative methods of treatment.

Patients with stone in the ureter who come to the clinic for treatment are seen and examined in the department of urology. After the diagnosis has been made the non-operative methods are employed. Braasch,[2] who has removed about 126 calculi in this manner, dislodges the impacted calculus by a ureteral catheter or a small sound. His results have been very satisfactory, and he believes that all patients should have the benefit of an attempt to remove the stones without operation. Braasch's

definite contra-indications to further attempts to dislodge stones are: (1) A stone 2 cm. or more in diameter; (2) acute ossification with continuous obstruction; (3) acute renal infection; (4) the patient's intolerance to cystoscopic manipulation, and (5) anatomical deformity. If the renal infection is severe intra-ureteral methods should not be attempted, and the operation should be undertaken with the idea that it may be necessary to remove the kidney.

The results of non-operative methods will depend largely on the manner in which they are used. Braasch has had excellent results with dislodging stones with ureteral catheters and he has also had some good results with papaverin. In nearly all the cases in which the stone presents at the ureteral orifice he has succeeded in removing it by means of the Bransford Lewis and other types of instruments. It is difficult to decide just how many times these non-operative measures should be repeated; the success of the attempt and the pain and discomfort to the patient may well be deciding factors. In some cases, undoubtedly, such treatments have been carried too far, producing infection in a normal kidney, and considerable trauma to the ureter and bladder. It should be borne in mind that while this non-operative treatment was being perfected many improvements were made in the surgical treatment, and the results of operative procedures are now very satisfactory.

A stone lodged in the ureter may result in pathologic changes in several different tissues. In many cases the ureter is dilated above the stone and in some instances this dilatation is marked, so that the ureter seems almost as large as the small intestine. In such cases the wall of the ureter is thick, with definite signs of inflammation. At times the stone completely blocks the ureter and there is an accompanying hydronephrosis. Unless the kidney is extensively infected it need not necessarily be removed, since after the stone is removed sufficient renal function may remain to warrant saving the kidney. The same condition may result whether the stone is large or small. Contrary to this is the case in which the ureter, on exposure, appears normal in size and appearance, a condition noted in many

of our cases. The stone seems almost to fill the lumen of the ureter, and yet there is no dilatation and no evidence to show that the ureter has previously been dilated. The improbability that these stones descend through the apparently normal ureters seems to be evidence of the fact that some of these calculi may form in the ureter itself, possibly at the site of a stricture. This type of stone is small and it is often difficult to locate it in a seemingly normal ureter. It is undoubtedly true that stricture of the ureter occurs in association with stone, and it is quite probable that in some of our cases in which there was not immediate complete relief of symptoms after the stone was removed a stricture caused the trouble. I have been impressed with the infrequency of any gross evidence of a stricture. Even in cases in which difficulty was experienced in removing an inaccessible stone and in those in which the stone had perforated the ureter and produced much peri-ureteral infection we have not seen a stricture of any consequence. In some of our cases there was delay in the closure of the urinary sinus, but in all the sinus was completely closed within a few weeks, and no permanent fistulæ occurred. There must have been stricture in some of our cases, but I believe that in most instances the condition is spontaneously relieved.

The same conditions follow the removal of stone by the non-operative and the operative methods. In several cases we have found the ureteral calculus lying in an abscess cavity outside the ureter, and in all of these the condition was relieved by the removal of the stone from the abscess pocket and drainage of the abscess without any endeavor to manipulate the ureter. If a pyelonephritis has resulted from the stone and there is evidence of more or less general infection it is inadvisable, if there is a good functioning kidney on the opposite side, to remove the stone and establish drainage. In many of these cases the damage to the kidney is already beyond recovery, the immediate results will not be satisfactory, and the kidney will have to be removed later. In the extreme case, if the stone is in the lower third of the ureter so that a very large incision, or in some instances two incisions, would be required to remove the

kidney and the ureteral stone, it is best to remove the kidney and leave the ureter and stone, removing the stone later if necessary. In two of our cases we were obliged to remove the calculus from the ureter at a later date because of pain. Before operation it may be impossible to determine the amount of function in the affected side, as it is sometimes impossible to collect the urine because of the presence of the stone. In these cases I believe the best plan is to remove the stone and preserve the kidney if we are not aware of infection in the kidney at the time. Conservative methods are justified in any case of chronic infection of the kidney, but radical methods must be employed in acute severe infection, and nephrectomy should be done before severe uremia and toxemia threaten.

In two of our cases complete anuria was produced by stone in the ureter. In Case I (A195194) the patient had been operated on by W. J. Mayo five weeks before for hypernephroma of the left kidney. The patient made an uneventful recovery from the nephrectomy, was discharged from the hospital, and was about to leave for home when he noticed that his urine had diminished greatly. He told of having passed stones, probably from the right side, some time before, and of having colic, which suggested a stone on the right side. Finally the urine stopped completely and treatment was instituted for suppression, but aside from the fact that there was little evidence of edema the patient did not appear to be sick. Grenshaw catheterized the right ureter and met an obstruction about 5 inches from the bladder which the roentgen-ray showed to be a stone. The patient had passed no urine for six days when I operated, removing the stone from his right ureter. The ureter was greatly dilated and filled with turbid urine. The kidney started to functionate apparently as soon as the pressure was relieved, a large amount of urine was secreted, and the patient made a complete recovery.

In Case II (A205789) the man gave a history of having been operated on several months before for stone in the left ureter. He came to the clinic because of a persistent urinary sinus through the scar on the left side. Braasch's examination re-

vealed a stone in the right ureter about 6 inches from the bladder, and a ureteral catheter was passed to the scar of the operation on the left ureter. The patient was passing about equal amounts or urine from the bladder and the sinus in the left flank. Shortly after the examination the urine stopped completely. We tried again to probe the urinary sinus on the left side but were not successful. For six days there was no urine passing from the sinus or the bladder, and yet the patient apparently was having no trouble because of it. I then removed a stone from the right ureter which was greatly dilated and filled with turbid urine as in Case I. Because of the evident infection no effort was made to close the opening in the ureter, and the urine drained for several days, after which the wound healed completely. At this time the sinus on the left side, which we had not been able to open with a probe, opened spontaneously and drained urine. A month after removing the stone from the right side, I operated through the scar on the left side, and closed the left ureter, which was greatly scarred and thickened. Examination of the ureter revealed no cause for the persistent sinus and trouble except extension of scar tissue and stricturing. I excised much of the scar tissue and reconstructed the ureter over a small tube, which was pushed down the ureter so that it projected into the bladder. The tube was removed some days later by means of the cystoscope. The sinus did not reform, and the ureter was patent at the time the patient was discharged.

The most striking feature in both these cases is that, in spite of the fact that no urine escaped for six days, the patients did not appear to be sick.

In our few cases of bilateral ureteral calculi, it has seemed best to remove the stones by operation rather than by non-operative methods. We usually operate on one side at a time, although in some instances we have removed stones from both ureters at one operation. The side showing evidence of acute trouble is operated on first, if there is no apparent difference we prefer to remove the stone from the ureter on the side having the best function.

The cases in which operation has been done between the years 1901 and 1918 are tabulated in Tables I to XIV. During this same time Braasch has removed ureteral stones in about 126 cases by non-operative methods. During the same period we operated on 400 patients. In our earlier cases no attempt was made to remove the stone by non-operative methods. We find it is difficult to estimate just what percentage of ureteral calculi may be removed by non-operative methods, but probably the percentage is often given too high. Roughly estimated, I should say that at the present time about one-half the patients require operation in order to rid them of the stone; in other words, they will be better off if the stone is removed by operative methods.

Forty-eight (12 per cent.) of the 400 patients operated on had passed stones or gravel before operation; in 9 cases multiple stones, averaging 6, had been passed, and yet in all these cases impaction of a stone in the ureter necessitated operation.

The diagnosis of ureteral stone by roentgen-ray and cystoscopy has been developed almost altogether since 1901, so that a much higher percentage of accuracy in diagnosis will be found in the later cases than in the cases of earlier years.

Our study shows that the results of operations for the removal of stone in the ureter have been almost universally satisfactory. Of this series of 400, two of the patients operated on have died, and only one of these deaths could be attributed to the operation. In the first case an infected appendix was removed; the patient had a left hydronephrosis and a right-sided nephritis; he died of peritonitis. In the second case death resulted at about the end of two weeks from infection and extravasation of urine.

Convalescence following the operation is usually short and not attended by any difficulties. In some instances the urine drains freely for several days, and in others, even though the opening in the ureter has not been closed, there will be very little, if any, drainage. In the non-infected cases in which it is feasible to close the opening in the ureter the wound heals primarily.

During the past few months, Scholl has made a careful review of the histories of these cases, and has sent out "follow-up" letters to all the 400 patients, and answers have been received from nearly 300. In approximately 90 per cent. of these complete relief of former symptoms had ultimately resulted. A number of the patients mentioned the fact that they had pain in the same side and of the same character persisting for several weeks after the operation, but in most instances by the end of six months the pain had entirely disappeared. Twenty-one patients had pain severe enough at some time or other to require morphia. About 15 per cent. of the patients complained of frequency, and some of them of hematuria lasting for several weeks after the operation, thus showing that the infection which existed at the time of operation had a tendency to clear up later. Twenty-six of the 400 patients have passed stones since the operation. Of course, it is impossible to say whether these stones came from the kidney, the ureter on the side operated on, or the opposite side.

The technic of the operation for the removal of stone from the ureter differs according to the location of the stone. If the stone is situated at the uretero-pelvic juncture, or at any place in the upper third of the ureter, the best approach is through the Mayo posterior-lateral incision, the same incision as employed to explore the kidney. If the calculus is situated in the lower two-thirds of the ureter, the straight rectus incision gives the best exposure, the exact position of the incision depending on whether or not the calculus is in the middle or lower third of the ureter. Under ordinary circumstances the operation should be performed without opening the peritoneum since less opportunity is allowed for infection. If the peritoneum is accidentally opened it should cause no alarm, although care should be taken accurately to close it. Since the retroperitoneal space is opened by retracting the peritoneum away from the posterior muscles the ureter will probably retract with the flap of peritoneum, so that the search for the ureter should be made on the posterior surface of the peritoneum and not on the anterior surface of the muscle. If the

stone is large the ureter is usually readily located by palpation. The greatest difficulty arises in locating a small stone in the lower end of a non-dilated ureter; fortunately this is the type of case most often relieved by conservative methods. Several years ago I called attention to a technic for exposing this part of the ureter and removing such stones. The operation consists in complete exposure of the lower end of the ureter in the manner employed in operating on the bladder for neoplasm or diverticulum. The entire lower third of the ureter is brought into view. After the stone has been removed it is best, I believe, loosely to close the opening in the ureter. Since Abell reported the series of cases in which he employed this technic I have used it many times without any ill effects, and I am sure that it has made convalescence much easier and shorter. The ureter has not healed in all cases without some drainage, but it has in many, and in others the urinary drainage was very slight. Stitching the ureter without penetrating the mucosa seems to be of distinct advantage.

Conclusions. 1. The study of this series of 400 patients operated on for ureteral stone and the 126 patients treated by Braasch leads us to conclude that before instituting any method of treatment for the removal of stones from the ureter, it is well to bear in mind that a large percentage of such stones pass voluntarily; in the early cases, therefore, it is best to delay treatment.

2. Unless there are definite contra-indications to non-operative treatment for the removal of the stones, an attempt should be made to remove them by non-operative methods. We doubt the advisability of attempting to remove stones from the middle and upper third of the ureter in this manner, but believe that with the development of the method nearly all small stones may be removed from the lower end of the ureter without operation.

3. While the operation for the removal of calculi from the ureter must be considered a major operation, it may be performed with practically no mortality and with universally good results. Therefore, if there is a definite contra-indication to

non-operative treatment or if progress is not being made by such treatment, the stone should be removed by open operation without hesitation.

TABLE I

Patients with Ureteral Stones Operated on at the Mayo Clinic, 1901–1918 inclusive

		Cases
Total number		400
Males	248	
Females	152	
Location:		
Right ureter		197
Left ureter		195
Bilateral involvement		5
Not stated		3

TABLE II

Age at Onset of Symptoms

0 to 10 years	10
10 to 20 "	38
20 to 30 "	129
30 to 40 "	125
40 to 50 "	61
50 to 60 "	25
60 to 70 "	8

Average age, 32.4 years.

TABLE III

Age of Patients on Entry to Hospital

0 to 10 years	4
10 to 20 "	5
20 to 30 "	87
30 to 40 "	135
40 to 50 "	108
50 to 60 "	42
60 to 70 "	12
70 to 80 "	2

Average age, 37.7 years.

TABLE IV

Duration of Symptoms	Cases.
1 year	138
2 years	60
3 "	27
4 "	23
5 "	22
5 to 10 "	62
10 to 15 "	33
15 to 20 "	19
20 to 30 "	11

Average duration of symptoms, 4.8 years.

Patients entering hospital after symptoms of one year's duration	34 per cent.
Patients entering hospital after symptoms of two years' duration	49 per cent.

TABLE V

Pain Referred To

Region of kidney	281
Right loin	123
Left loin	142
Both sides	16
Lower abdomen	55
Right	33
Left	22
Suprapubic region	5
Upper abdomen	63
Right	34
Left	27
Epigastric region	2
Genitals	5

TABLE VI

Bilateral Kidney Pain

Stone in opposite ureter also	4
Stone in opposite kidney also	5
Pyelonephritis on opposite side	1
Not determined	6

Gross Hematuria

71 cases	17.4 per cent.

Bladder Irritability

129 cases	32.1 per cent.

TABLE VII

Urinalysis

	Cases
Pus	102
Blood	39
Pus and blood	191
	332 (82.6 per cent.)

TABLE VIII

X-ray Findings

Positive	295 (60.0 per cent.)
Negative	36 (9.0 per cent.)
Negative in 1919—of 193	11 (5.7 per cent.)

Cystoscopic Findings

Definite obstruction to ureteral catheter	240 (60.0 per cent.)
No obstruction	109 (27.2 per cent.)
Stone visible at meatus	1 (1.0 per cent.)

TABLE IX

Previous Operations

	Cases
Ureteral stone, same side	3
Ureteral stone, opposite side	1
Renal stone, same side	4
Renal stone, opposite side	1
Negative renal exploration, same side	3
Negative renal exploration, opposite side	1
Nephrectomy, opposite side	5
Nephrectomy, same side	2
(Nephrectomy was done five and seven years before, but stone was left in the ureteral stump.)	
Bladder stone	2
Appendectomy	54
Other abdominal operations	68
	144

TABLE X

Negative Explorations

Stone found in bladder	5
Definite signs of stone found at operation. (Stone had probably passed before operation)	3
Stone passed one month after operation with definite renal colic (stone probably in ureter but not located)	1
Probable mistaken diagnosis	4
Mistaken diagnosis in 1919 group of 193 cases	1

TABLE XI

Location of Stones

	Cases.
Ureteropelvic juncture	38
Upper third of ureter	49
Middle third of ureter	7
Iliac crest	4
Lower third of ureter	198
Ureterovesical juncture	53
Intramural	32

TABLE XII

Bilateral Involvement

Bilateral ureteral	5
Stone in same kidney	29
Stone in opposite kidney	9
Stone in bladder	1

TABLE XIII

Duration of Symptoms before Nephrectomy for Ureteral Stone

	Cases.
1 to 5 years	22
5 to 10 "	11
10 to 15 "	8
15 to 20 "	6
20 to 25 "	2
25 to 30 "	2

Average, 8.5 years.

16 of these patients had stone in the kidney also.

Mortality

Case 216040: Operation, ureterolithotomy; patient died thirteen days after operation; marked urinary extravasation was found.

Case 72640: Operation, combined ureterolithotomy and appendectomy; patient died of general peritonitis.

TABLE XIV

Information Received in Answer to "Follow-up" Letters

Operations since leaving the clinic	12
For ureteral stone, opposite side	2
For ureteral stone, same side	0
For renal stone, same side	1
Nephrectomy, same side	4
(1 case complicated with nephrolithiasis)	
Nephrectomy, opposite side	1
Negative renal exploration, same	3
Stones passed since operation	31
Stones passed previous to operation	48 (12.3 per cent.)
Multiple stones (averaging 6) passed previous to operation	9

Letters received on an average of four and one-half years after operation stated that ureteral stone had occurred on the same side in 3 cases. In 2 the first operation had been performed in the Mayo Clinic, and in one it had been performed elsewhere.

BIBLIOGRAPHY

1. Abell, I: Surgery of the Ureter. Louisvill Month. Jour. Med. and Surg., 1907–1908, xiv, 6–12.

2. Braasch, W. F., and Moore, A. B.: Stones in the Ureter. Jour. Am. Med. Assn., 1915, lxv, 1234–1237.

3. Hunner, G. L.: The Etiology of Ureteral Calculus. Surg., Gynec. and Obst., 1918, xxvii, 252–270.

4. Judd, E. S.: A Method of Exposing the Lower End of the Ureter, Ann. Surg., 1914, lix, 393–395.

5. Lewis, B.: Presentation of a Patient, the Subject of Calculous Formations in the Kidney, Ureter and Bladder; the Kidney Inactive; Removal of the Stones from the Only Active Kidney by Nephrotomy, and from the Bladder by Means of the Operative Cystoscope. St. Louis Med. Rev., 1903, xlvii, 433–435.

6. Lewis, B.: Some New Instruments in Operative Cystoscopy. Jour. Am. Med. Assn., 1918, lxxi, 1797–1799.

7. Mayo, W. J.: The Incision for Lumbar Exposure of the Kidney, Ann. Surg., 1912, lv, 63–65.

8. Rovsing: Erfahrungen über Uretersteine. Monatschr. f. Urol., 1901, vi, 385. Quoted by Hunner.

URETERO-URETERAL ANASTOMOSIS

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Anastomosis of the resected or incised ends of the ureter may be classed as an uncommon operation. Only rarely does the surgeon remove portions of the ureter deliberately. If this be done for malignant disease, anastomosis of the ureter with the bladder is usually chosen as a less hazardous procedure than uniting the cut ends of the ureter. Only rarely is the ureter severed accidentally by the skilled surgeon, and when the accident occurs in unskilled hands more often than not it goes undiscovered and the patient's death is ascribed to shock or peritonitis.

Since the operation of uretero-ureteral anastomosis is rare, it becomes the duty of the surgeon to record in detail each case, especially the end results, so that doubtful points about the operation may be eventually cleared up as data accumulate. The task of the reporter, however, has been made more difficult by improvements in the methods of direct examination of the genito-urinary tract made during the past twenty years. A patient with an anastomosed ureter cannot be pronounced cured, so far as the operation is concerned, until bladder, ureter and the corresponding kidney have been explored, functional tests performed and ocular demonstrations of the condition of the urinary tract made by the roentgen-ray. Without such work the cured patient may in reality be one with an atrophic or hydronephrotic kidney where the repaired ureter leads to the bladder but does not functionate, the patient being "perfectly

well" because the other kidney and ureter are doing double work very satisfactorily.

Fortunately, I am able to report the following case of uretero-ureteral anastomosis subject to the conditions set forth above: Mrs. H., gynecological case No. 10387, aged forty-nine years, widow, was referred to the University Hospital, May 13, 1919, by Dr. L. B. Hixson of Durand, Michigan, for malignant disease of the cervix. Although there had been a history of irregular and profuse bleeding for over a year, examination upon entrance showed the uterus to be freely movable with no induration to be made out in the broad ligaments. Microscopic examination of a piece of the affected cervix having established the diagnosis of medullary squamous-celled carcinoma the patient was subjected to the radical abdominal operation for the removal of the cancerous uterus May 16, 1919.

Operation. The ulcerated, cancerous cervix was thoroughly cauterized through a water-cooled speculum prior to opening the abdomen. The broad ligaments were opened in the usual manner after ligation of the round and infundibulopelvic ligaments. Unfortunately the usual technic was departed from in tying the right uterine artery after first exposing the corresponding ureter. Long familiarity with the radical operation led me to omit the passage of the forefinger along the ureter and beneath the uterine artery. Instead a curved ligature passer was supposedly carried along the ureter and the artery ligated between two ligatures. Much to my chagrin I at once realized that the ureter had been divided—in other words, the ligature passer had gone below the ureter as well as the uterine artery. The left uterine artery was ligated by the usual technic and the uterus with its appendages together with a wide vaginal cuff removed.

The incised ends of the ureter were then united in the following manner: The distal or bladder end of the cut ureter was split with scissors on its anterior surface for a distance of one-fourth inch. The mucosa at this end was trimmed off for a short distance and the lumen of the duct stretched slightly with a hemostat. The proximal or kidney end of the ureter was

then transfixed with a fine cambric needle armed with a fine linen thread. Both ends of this suture were threaded through a straight needle, which was passed through the lumen of the distal end of the ureter and out of the duct one-third inch below the angle of the slit on the anterior surface of the ureter. The proximal end of the ureter was drawn one-third inch into the distal end by means of this traction suture, which was steadied by an assistant but not tied. At the point of juncture of the upper with the lower portion of the ureter the walls were united by five fine silk sutures passed by a fine curved needle. These sutures included all coats of the two portions of the ureter except the mucosa. The slit portion of the distal end was then united with three fine silk sutures, which also passed through all but the mucosal coat. The traction suture was now removed and the anastomosed ureter placed as nearly as possible in its proper position. The two cut edges of the pelvic peritoneum were brought together by a running catgut suture over the ureter and a small piece of gauze drain run out through the vagina. Both ureters were left completely peritonealized.

The patient naturally was somewhat shocked by the combination of a radical abdominal hysterectomy and the ureteral anastomosis, and for a few days the pulse-rate was somewhat elevated. There was no leakage of urine by the vagina. The usual postoperative amount of urine was secreted and chemical and microscopic examination showed nothing abnormal. The patient voided urine shortly after the completion of the operation, and catheterization was never necessary.

The patient returned to the hospital December 12, 1919, for an examination. A careful bimanual examination showed no signs of a return of the carcinoma. Through the kindness of my colleague, Dr. Hugh Cabot, it was possible to obtain a very complete report of the condition of the right urinary tract. His report is as follows:

December 10, 1919. Case of Mrs. H., gynecological case No. 10387. Report from Department of Roentgenology, Dr. J. G. Van Zwaluwenburg, December 1, 1919: "Plates of the kidney region in the double screen technic before and after injection

FIG. 1.—Roentgenogram of right ureter and pelvis of kidney showing moderate dilatation of ureter and pelvis of kidney. No. 6 F. catheter.

FIG. 2.—Right ureter 6 months after an end-in-end uretero-ureteral anastomosis. Fluid ran back from pelvis of kidney around No. 5 F. catheter, filling the bladder.

of opaque fluid. Before injection the roentgen-ray catheter is seen in place following the usual course. The kidney shadow is not remarkable. In the plate taken after the injection of the bromide the calyces of the right kidney are seen to be much dilated. The kidney shadow does not seem to be enlarged. The ureter appears to be dilated to some extent throughout its length, but more especially from the fifth to the third lumbar vertebra.

"We believe that this patient has a minor degree of dilatation of the terminal calyces, pelvis and ureter.

"Examination of bladder shows nothing abnormal. Ureteral orifices symmetrical. No evidence of inflammation. No. 6 F. catheter passed freely to the kidney, both sides. No obstruction. Normal flow of normal appearing urine from both kidneys. Kidney function as tested by phthalein shows appearance time on right of five minutes on left four minutes. Function of right kidney in ten minutes 5 per cent., of left 10 per cent. Capacity of right renal pelvis 16 c.c. Flow from right side was steady and suggested dilatation and paralysis. Examination in the bacteriological laboratory of 9.25 c.c of urine from the right side showed no organisms; no growth obtained. Injection of 25 per cent. solution of sodium bromide; radiograph taken. 15 c.c. withdrawn from the pelvis after roentgen-ray finished. Examination of the plate shows a moderate degree of dilatation of the renal pelvis and flattening of the calices. I should regard it as a first degree of hydronephrosis.

"Opinion.—This woman has a very slight dilatation of the renal pelvis and definite diminution of renal function on the right side. There is no evidence of infection, and the amount of damage to the kidney as a whole must be regarded as exceedingly slight."

Twenty-three years ago at the Nashville meeting of this Association our distinguished Fellow, Dr. Bovée, presented his classical paper on uretero-ureteral anastomosis. At this meeting of the same association we are able to state that almost all his conclusions have been completely justified by subsequent surgical ureteral work. In order to study this work and draw

certain conclusions from it I have carefully gone over the literature of the subject and collected 72 cases of ureteroureteral anastomosis by various methods. Other cases, where wrong references have been given or where insufficient data have been furnished, have been placed in another group together with their references in order to save the time and energy of some subsequent investigator.

Bovée's first conclusion that "uretero-ureteral anastomosis is a perfectly feasible procedure" is amply borne out by a study of the 72 collected cases. It is assumed that by feasible is meant not only that the two ends of a divided or resected ureter can be united without causing the death of the patient from leakage, but that the patency of the tube can be accomplished by such surgical procedures. Evidently the ends of almost any severed ureter can be sutured together, but if stenosis follows it may amount to the same thing as tying off the ureter.

Again the cases must be scrutinized carefully to see if the deaths occurred from the ureteral operation or from the operation giving rise to the accident. Had the patient in my own case died of shock from the combined radical hysterectomy and ureteral anastomosis, while the latter procedure might have contributed toward the death, due to the prolongation of the entire operative procedure, such death could not be counted against the feasibility of ureteral anastomosis. There were 4 deaths out of 72 cases directly attributable to the ureteral anastomosis, or a primary mortality of 5.5 per cent. Certainly this is not a prohibitory mortality, especially since all of them occurred in the early days of ureteral surgery.

It is even questionable if Morris's case should be included among deaths attributable to the operation, since in all probability the large uterine myoma for which the primary operation was performed had produced double hydronephrosis by pressure. At autopsy both kidneys were excessively hydronephrotic, the right more than the left, although the latter had been cut and anastomosed. The left ureter was found to be watertight. Still, since hydronephrosis was found so soon after

the operation, the case was included among deaths attributable to the anastomosis. In Blau's two cases death resulted from defective suturing and retroperitoneal abscess in the posterior wall just back of the sutured ureter. Although cardiac insufficiency is given as the cause of death in Sadowski's case, the autopsy showed dilatation of the ureter above the suture with an edematous hydronephrotic kidney. In the other cases in which death followed one or the other methods of ureteral anastomosis (Schopf, Hochenegg, Pawlik, McMonagle, Gubareff, Cobb) the deaths were unquestionably due to other causes than the results of the ureteral anastomosis.

Bovée's second, fifth and sixth conclusions that ureteral anastomosis is preferable to nephrectomy and ligation of the ureter in the light of the results from more than 60 cases of ureteral anastomosis recorded since the publication of his paper have been shown to be perfectly sound.

As regards the third conclusion that the preferable method is the lateral implantation or oblique end-to-end anastomosis, subsequent operations have shown the primary results of all methods to be fairly good, with the advantage somewhat in favor of the end-in-end or end-in-side methods. There were 29 cases of end-to-end anastomosis with 6 deaths, 4 of which were due to the operation (Group I), while in 25 transverse end-in-end and 15 end-in-side, 40 cases in all, there were no deaths which could be attributable to the operation (Groups II and III).

Looking at the question in another light it is perfectly possible that a certain operative technic will be without mortality, yet be a failure so far as functional results are concerned. Leakage after the anastomosis is a sign of faulty technic, since such leakage can only cease by the formation of granulation or scar tissue and the increasing risk of stricture which may or may not lead to hydroureter and hydronephrosis. In 29 cases of end-to-end anastomosis leakage was recorded in 9 cases, while in 25 transverse end-in-end there were only 5 cases of leakage, and in 15 cases of end-in-side only 2 cases of leakage. In other words the leakage after anastomosis in 40 operations

with the last two methods was 2 less than recorded in 29 cases by the transverse end-to-end method.

Personally, I do not see that one is called upon to choose the end-in-side method in preferance to the end-in-end method, with a view of thereby avoiding a stricture at the point of anastomosis. I believe the case reported above demonstrates beyond dispute that when the anastomosis is followed by primary union the end-in-end method need not and probably rarely produces a permanent stricture. It is the simplest of all the methods and sacrifices but a small portion of the ureter, since it is necessary to invaginate only one-quarter or one-third inch of the proximal portion of the ureter. When considerable portions of the duct have been accidentally or deliberately resected and the tension is rendered too great by invagination of even a small part of the ureter it is possible that transverse end-to-end anastomosis may be the preferable operation. Even here I would prefer approximation of the severed ends after loosening the bladder or kidney and the completion of the operation by the invagination method.

I am unable to see the advantage of the non-removal of the traction sutures. Certainly not if the suturing about the joint made by the insertion of one end of the severed ureter with the other can be made accurate and firm enough to prevent the slipping out of the proximal end. Removal of the traction suture does away with any chance of leakage through the suture tract, while the avoidance of the mucosal coat in the suturing about the joint also serves to prevent any leakage from a similar cause at this point. Finally, I believe that when the mucosa is removed for a short distance within the distal end of the tube, firm union takes place rather rapidly, and that this is an important part of the technic so far as the prevention of leakage is concerned.

Retroperitoneal drainage should undoubtedly be employed, care being taken that the drain does not come in contact with the anastomosis. Since the large majority of the anastomoses will be in women, it is comparatively easy to drain retroperitoneally through the vagina. The ureteral anastomosis should always be carefully peritonealized; and as the duct is shut away

from the general abdominal cavity in a comparatively few hours, subsequent escape of urine from an imperfect anastomosis would be harmless so far as mortality is concerned.

It would seem as if the complicated methods of Monari and Soresi (Group 6) for uniting the severed ends of the ureter were too complicated and unnecessary. Each method was devised to prevent ureteral stricture, which experience has shown does not follow simpler anastomotic methods. Monari's method employed by Fournier in one case (Group 5) is a side-to-side lateral anastomotic method, while Soresi's method is a combination of the transverse end-to-end and side-to-side methods.

It must ever be borne in mind that from the nature of things ureteral anastomosis will always be a rather rare operation; hence a simple safe method must be adopted and its principles grasped, so that when called upon to unite the severed ends of a ureter the surgeon will not be obliged to recall a complicated technic which he has not had an opportunity of becoming familiar with. Lateral anastomosis of the intestinal tract is a perfectly satisfactory operation, because the surgeon has frequent opportunities to become familiar with the technic, while such a procedure as applied to the ureter would be bound to fail in a certain proportion of cases because of the lack of familiarity.

It follows from what has been previously stated that Bovée's oblique end-to-end anastomosis employed successfully by him in one case (Group 4) is an unnecessary refinement of technic, since successful anastomosis of the ureter without stricture can be made by the simpler end-in-end invagination method. Possibly Bovée had arrived at the same conclusion when he employed this latter method in a second case of ureteral anastomosis.

The necessity of careful examination of the urinary tract which has been subjected to uretero-ureteral anastomosis has already been referred to. Without such an examination the reporter is simply guessing, for it is a well-known fact that a patient may apparently be in perfectly good health with an atrophic or hydronephrotic functionless kidney. Very few

operators have recorded such postoperative urinary tract examinations.

McMonagle as early as 1895 made a cystoscopic examination of the bladder of a patient whose left ureter had been successfully anastomosed by the transverse end-in-end method one year previously. He satisfied himself that the ureter was permeable, since he saw urine coming from the ureteral orifice. Three years later the woman was in good health. An exceedingly valuable observation, and one far in advance of his time, but we are still left in doubt as to what happened to the left ureter and kidney between the date of this examination and the last report three years later. The patient may have been well with a functionless kidney and ureter.

Bovée found upon passage of a ureteral catheter six months after his case of oblique end-to-end anastomosis that the ureter was without stricture. Forssell makes the same observation about his case of end-in-end anastomosis, the ureteral sound revealing no stricture two years after the operation. Pozzi and Kayser passed ureteral catheters after end-in-end anastomoses and found both absence of stricture and that the kidney function was normal, although Pozzi thought there was a difference in the flow of urine from the operated side and explained the continuous flow of urine from this side as due to a lack of contractility (peristalsis) from that side. Lavisé reports the ureteral orifice and bladder normal three weeks after end-to-end anastomosis. Davis collected the urine from both sides of the bladder by the Harris segregator one month after an end-in-end uretero-ureteral anastomosis and demonstrated the operated ureter to be patent and the urine normal. Perlis by cystoscopic examination after an end-to-end anastomosis was able to report that clear urine came from both ureteral orifices. Fournier two months after a ureteral anastomosis by the Monari method found urine from both ureters normal. Reed four weeks and six months after an end-in-side anastomosis satisfied himself by the use of the Harris segregator that normal urine came from both ureteral orifices.

These are the only observations I have been able to find in

connection with the 72 collected cases of ureteral anastomosis, and it will be noted that in no case is any information furnished beyond the permeability of the sutured ureter and the condition of the urine coming from that side. We are left absolutely in doubt as to the size and condition of the pelvis of the kidney and ureter on the operated side, points to be settled if we are to be in possession of all facts as to what happens after the ureter is cut and united.

It has been impossible to draw any definite conclusions regarding the functional results of ureteral anastomosis in the 72 cases. As has been before pointed out, the fact that a patient is in good health and suffers from no pain so many months or years after the anastomosis means very little so far as proving that the operated ureter and corresponding kidney are functionating.

A good example is Frederick's case reported in 1901. About 1895 he did an end-in-end uretero-ureteral anastomosis of the right ureter, an inch of which had been removed during a hysterectomy for a uterine fibroid. Then followed vaginal leakage for about eight months, when the patient developed symptoms of acute hydronephrosis accompanied by cessation of the leakage. Frederick reported the patient as perfectly well five years subsequent to these symptoms. Fortunately, some ten years later he was able to secure an autopsy on this patient. The autopsy showed stenosis at the point of the anastomosis, dilatation of the ureter above the anastomotic point to the size of the thumb and a hydronephrotic kidney the size of a child's head.

Had it not been for Frederick's scientific interest in this case leading him to follow it up for a good many years it would have been called a cure when in reality it was a functional failure. Although the patient survived the anastomosis the resulting condition was such as to be followed by ureteral leakage, hydroureter and hydronephrosis, chronic in form and giving rise to a few symptoms, but enough to cause death fifteen years later. Nephrectomy would have been the preferable operation here could the subsequent history of the patient have been foretold.

When uretero-ureteral anastomosis is not followed by leakage there is an excellent chance of good surgical and functional results. When the anastomosis is followed by leakage, success surgically and functionally must be, from the nature of the case, rare. Each such case should be carefully watched, with a view of subsequent surgical interference. In case the leakage be permanent, nephrectomy may be indicated in preference to a second attempt at uretero-ureteral anastomosis, when the ureter and kidney have been greatly changed by adhesions and resulting compression at the site of the anastomosis.

There will be very little argument regarding the possibility that hydroureter and hydronephrosis with or without accompanying infection may follow defective ureteral anastomotic suturing. Yet the statement that every repair of a sectioned ureter will be followed by distinct pathological changes in the ureter and kidney may not be so readily accepted. Yet there is a certain amount of evidence to support the truth of such a statement.

Alksne, of the Federoff Surgical Clinic in St. Petersburg, in 1908 published an exhaustive experimental study of the different methods of uretero-ureteral anastomosis. Many of his dogs subjected to the anastomosis died, so that one is forced to question the excellence of his operative technic. Still not a few of the animals lived and showed good surgical successes so far as the anastomoses were concerned. The interesting part of the research to me is the author's conclusions which in part may be stated as follows: Experiments show that all ureteral sutures are followed by a certain stenosis of the duct from traumatic edema. The suture of the ureter may be perfect, yet the functional result may be poor. All sutured ureters show a characteristic type of excretion of the urine. Atony of the sutured part causes cessation of the peristaltic waves of the ureter giving rise to ureteral pocket formations. The urine accumulates in these pockets above the point of suture until enough has accumulated to force it below the anastomotic point. This will lead in all cases to hydroureter and in most cases to hydronephrosis.

How else can the findings in the case just reported be explained? Clinically the result of the uretero-ureteral anastomosis was perfect so far as could be judged. There was no leakage, and nothing in the urine to show that there was infection of the urinary tract. Six months after the anastomosis, during which time there were no symptoms referable to the urinary tract, examination shows absolutely no signs of stricture, but a moderate degree of dilatation of the ureter and kidney and definite diminution of the renal function on the side operated upon.

This looks like a confirmation of Alksne's contention that changes in the ureter and kidney follow every case of anastomosis. Mechanically and surgically the result in the reported case was excellent. There was absolutely no evidence of a stricture at any point of the duct. Yet the ureter and pelvis of the kidney were dilated.

The explanation of what causes the "atony" of the sectioned ureter referred to by Alksne has not been worked out. He ascribes it to cutting through of the muscles of the ureter and scar formation. It is possible that section of the ureter interferes with its nerve supply so that atony results. It is idle to speculate as to the causes of the condition until the latter's existence has been established beyond question by the findings of more than one case. Hence the importance that each case of ureteral anastomosis be worked out carefully as regards the condition of the ureter and kidney.

Pozzi's and the present case also show evidence of hydroureter following the passage of the ureteral catheters. It will be recalled that Pozzi noticed a continuous flow of urine from the operated ureter and correctly ascribed it as due to a lack of or diminution of the normal ureteral peristalsis. The same phenomenon was present in my own case. This continuous flow of urine from the ureteral catheter is characteristic of hydroureter, and is even used by urologists as a diagnostic measure in determining the exact portion of the duct which is dilated.

Granted the correctness of the conclusion that every sec-

tioned ureter no matter how successfully repaired will be followed by a slight degree of hydroureter and hydronephrosis, such resulting condition may not be at all a menace to life or health provided infection does not occur or if the operation has not been performed upon ureters and kidneys already diseased. Evidently the danger of excessive hydroureter and hydronephrosis will be greatly enhanced when the anastomosis is made in a ureter already dilated. Even here provided primary union takes place a fairly serviceable ureter and kidney may be found after the anastomosis. Each case must be judged by itself, always bearing in mind that the functional result must inevitably be worse when the operation is performed on abnormal ureters.

The pathological changes will always be greater and the functional results worse when the surgical results are poor. Stenosis at the anastomotic point, from faulty technic causing stricture and stenosis or imperfect suturing giving rise to leakage, must almost invariably lead to marked degrees of hydroureter and hydronephrosis. Such conditions may cure themselves through atrophy of the kidney, or if infection supervenes may seriously menace the life of the patient if nephrectomy be not resorted to (Cobb, Morris).

Even if further observations prove that repair of the sectioned ureter will be followed by slight dilatations of the ureter and kidney and a diminution in the function of the latter it will not mean that the operation of uretero-ureteral anastomosis must be discarded. Even diminished function is better than the compete loss which follows nephrectomy or ligation of the ureter.

Conclusions. 1. No case of uretero-ureteral anastomosis can be classed as cured or successful until so proved by the most modern exploration of the repaired duct and the corresponding kidney.

2. A study of the literature of ureteral anastomosis by various methods shows that anastomosis by the end-to-end, end-in-end and end-in-side methods is a perfectly feasible procedure.

3. Not only can the duct be made patent with little or no stricture but a functionating kidney and ureter can result.

4. In skilled hands the primary mortality due to any one of the three methods should be very small.

5. Leakage after uretero-ureteral anastomosis, probably in the large majority of cases, means failure, since it leads usually to stricture, hydroureter and hydronephrosis.

6. Judged from this standpoint the invagination methods are preferable to the transverse end-to-end method, since they are followed by fewer cases of leakage.

7. The end-in-end method of anastomosis is the operation of choice, since it is extremely simple and sacrifices the minimum amount of the ureter.

8. As claimed by Alksne from an experimental study of the different methods of uretero-ureteral anastomosis there is evidence to show that every uretero-ureteral anastomosis, no matter how perfect may be the surgical result, will be followed by a slight degree at least of hydroureter and hydronephrosis.

9. Although such a claim is borne out by the findings in the case reported it needs to be confirmed by careful examination of other operated cases.

GROUP I.—TRANSVERSE END-TO-END ANASTOMOSIS

CASE 1.—Operated upon by Schopf (53), June 2, 1886. There was no leakage. The patient died 7 weeks after operation from tuberculosis. At autopsy the right kidney was found to be the size of a hen's egg, the parenchyma contracted, the kidney pelvis distended. There was amyloid degeneration of the left kidney. The right ureter was imbedded in connective tissue and resembled a linear cicatrix. There were phosphatic concretions on the bladder wall.

CASE 2.—Operated upon by Hochenegg (27), February 9, 1890. The patient died on the twentieth day, from hemorrhage. At autopsy the bladder and ureter sutures were found intact. The source of the hemorrhage was not found.

Case 3.—Operated upon by Fritsch (21), in 1891 or 1892. The patient recovered but the end-result is not given.

Case 4.—Operated upon by Tauffer (56). Both vaginal and abdominal drainage was used. The patient recovered and was reported "cured."

Case 5.—Operated upon by Tauffer (56). Both vaginal and abdominal drainage was used. The patient recovered and was pronounced "cured."

Case 6.—Operated upon by Cushing (14). Abdominal drainage was used. Leakage persisted for about 2 weeks. The patient recovered. "Perfect result" two years after operation; "good result" 2 years later.

Case 7.—Operated upon by Blau (5), in 1894. Vaginal drainage was used. There was some leakage. The patient recovered, but the result is not stated.

Case 8.—Operated upon by Busachi (6). There was leakage for a few months. The patient recovered and remained in "good health" for one year after operation.

Case 9.—Operated upon by von Eiselsberg (39), in 1896. There was leakage for 20 days. The patient recovered, but the result is not stated.

Case 10.—Operated upon by Blau (4), March 4, 1896. The patient died on the third day, from peritonitis. Autopsy revealed a defective suture and purulent peritonitis.

Case 11.—Operated upon by Poroschin (45). The patient recovered, and five weeks after operation the recovery was still reported "good."

Case 12.—Operated upon by Morris (40), July 21, 1897. The patient died 51 hours after operation. Autopsy revealed both kidneys hydronephrotic, the right more than the left; its parenchyma much atrophied. The calyces of the left kidney were greatly dilated; the cortical substance was very thin. Both ureters and renal infundibula were considerably dilated. The left ureter was quite watertight.

Case 13.—Operated upon by Gallet (22). The patient recovered, but the result is not stated.

CASE 14.—Operated upon by Lavisé (32), October 21, 1898. Vaginal drainage was used. Although there was some temporary leakage, the patient recovered. Cystoscopic examination of the urinary tract, November 13, 1898, failed to show the right ureteral orifice, but showed mucous membrane was rich in bloodvessels and the bladder was normal. The patient was examined later and was found to be in perfect health, with normal kidneys, not enlarged, and urine and micturition normal.

CASE 15.—Operated upon by Depage (16). There was no leakage, and the patient made a complete recovery.

CASE 16.—Operated upon by Allen and Briggs (2), March 6, 1899. Vaginal drainage was used. There was leakage for about 2 months. The patient recovered; the operation was probably successful.

CASE 17.—Operated upon by Blau (5), in 1899. The patient died on the second day. Autopsy showed a retroperitoneal abscess on the posterior wall just back of the sutured ureter.

CASE 18.—Operated upon by Kelly (30). Abdominal drainage was used. There was permanent leakage. The patient recovered but the result is not stated.

CASE 19.—Operated upon by Perlis (44). Abdominal drainage was used. The patient recovered. Six months after operation, cystoscopic examination showed function of ureter to be normal.

CASE 20.—Operated upon by Perlis (44). The patient recovered but the result is not given.

CASE 21.—Operated upon by Sawinow (51). The patient recovered; result not given.

CASE 22.—Operated upon by Sadowski (50). The patient recovered; result not given.

CASE 23.—Operated upon by Sadowski (50). The patient died on the fifth day from cardiac insufficiency. At autopsy a narrowing was found at the site of the suture. The ureter was dilated above the latter and was permeable. The kidney was edematous; hydronephrosis.

Case 24.—Operated upon by Hein (26). The patient recovered; result not given.

Case 25.—Operated upon by Hein (26). The patient recovered; result not given.

Case 26.—Operated upon by Williams (60), in September, 1909. The patient was cured and reports no trouble referable to the pelvic or renal regions one year later.

Case 27.—Operated upon by Broun (10). Vaginal drainage was used. There was some leakage although the patient recovered from operation. The result was failure, however, and the patient was operated upon again.

Case 28.—Operated upon by Gouverneur (33). There was some leakage but the patient recovered. The end-result was successful.

Case 29.—Operated upon by Gouverneur (33). The patient recovered; end-result successful.

GROUP II.—TRANSVERSE END-IN-END ANASTOMOSIS

Case 1.—Operated upon by Pawlik (43), March 28, 1889. The patient died from shock 14 hours after operation. Autopsy revealed bloody fluid in the abdomen, chronic peritonitis, perihepatitis, perisplenitis, fibrinous inflammation of the intestinal serous membrane. The sutured ureter was patulous; no leakage.

Case 2.—Operated upon by McMonagle (36), September 24, 1894. Vaginal drainage was used. There was no leakage. The patient recovered and was reported living and well five years after operation.

Case 3.—Operated upon by McMonagle (36), December 2, 1894. Vaginal drainage was used. The patient died from shock about 10 hours after operation. The end-result is not stated.

Case 4.—Operated upon by Mayo-Robson (49). The patient recovered and is reported well 6 months after operation.

CASE 5.—Operated upon by d'Antona (3), in 1895. The patient recovered but the end-result is not given.

CASE 6.—Operated upon by McMonagle (36), March 10, 1895. Vaginal drainage was used. The patient recovered. One year later, cystoscopic examination shows the urine coming from the repaired ureter. Three years after operation the patient is reported in good health.

CASE 7.—Operated upon by Frederick (20) in 1895 or 1896. Vaginal drainage was used. There was leakage for about 8 months. The patient recovered. Several years later the patient died and examination at autopsy showed stenosis at the anastomotic point; the ureter dilated above suture to the size of the thumb, was sacculated all the way up; hydronephrosis, with the kidney as large as an infant's head thinned out and degenerated.

CASE 8.—Operated upon by Winslow (61), June 16, 1897. The patient recovered; end-result not given.

CASE 9.—Operated upon by Markoe and Wood (38), November 24, 1897. Both vaginal and abdominal drainage was used. There was some leakage for several days. The patient recovered, but the end-result is not stated.

CASE 10.—Operated upon by Noble (42), July 2, 1898. The patient recovered; the end-result is reported as successful.

CASE 11.—Operated upon by Noble (42), in October, 1898. Both vaginal and abdominal drainage was used. There was no leakage. The patient recovered and the end-result is reported as successful.

CASE 12.—Operated upon by Mackenrodt (34), in 1899. The patient recovered but died 2 years later from pneumonia. Autopsy showed a narrowing of the lumen in the repaired ureter; the left kidney smaller than the right and atrophic; hydronephrosis.

CASE 13.—Operated upon by Davis (15), February 26, 1900. Abdominal drainage was used. There was no leakage. The patient recovered. One month after operation a Harris segregator was passed. The ureter was patent and urine came from both sides.

Case 14.—Operated upon by Bovée (8), June 11, 1900. There was no leakage. The patient recovered; result not stated.

Case 15.—Operated upon by Coe (13), June 17, 1900. Vaginal drainage was used. The patient recovered and has remained well.

Case 16.—Operated upon by Turner (57), June 26, 1900. Vaginal drainage was used. The patient recovered and was "quite well" one year later.

Case 17.—Operated upon by v. Gubareff (25), in 1901. The patient died from amyloid degeneration of the abdominal organs. Autopsy 31 days after operation showed the ureter completely restored.

Case 18.—Operated upon by Cabot (11), May 3, 1901. Both vaginal and abdominal drainage was used. There was no leakage, the patient recovered. One year and 4 months after operation the abdomen was opened. The ureter at site of suture felt normal and there was complete restoration of function.

Case 19.—Operated upon by Wertheim (59), December, 1901. The patient recovered; function was restored.

Case 20.—Operated upon by Pozzi (46), May 29, 1906. Both vaginal and abdominal drainage was used. There was leakage for about 1 month. The patient recovered. Clear urine was obtained by catheter 3 months after operation.

Case 21.—Operated upon by Forssell (18), June 13, 1907. Drainage was used. The patient recovered. Two years after operation a sound was passed. The urine flowed from the repaired ureter; no obstruction.

Case 22.—Operated upon by McMurtry (37), in 1910. Drainage was used. There was no leakage for 3 days. The patient recovered. The result is not stated.

Case 23.—Operated upon by Schou (54). The patient recovered; favorable result.

Case 24.—Operated upon by Proust and Buquet (47), March 23, 1912. Both vaginal and abdominal drainage was used. There was leakage for about 18 days. The patient recovered. The result is not stated.

Case 25.—Operated upon by Kayser (29), May, 1914. The patient recovered. Four weeks after operation, a sound was passed. The repaired ureter was permeable, the kidney function normal.

GROUP III.—END-IN-SIDE ANASTOMOSIS

Case 1.—Operated upon by Kelly (31), May 1, 1892. Abdominal drainage was used. There was no leakage. The patient recovered; result not stated.

Case 2.—Operated upon by Emmet (17), November 22, 1894. Abdominal drainage was used. The patient recovered; result not stated.

Case 3.—Operated upon by Schauta (52), November, 1898. Drainage was used. There was leakage, but the patient recovered from operation. The result is not stated.

Case 4.—Operated upon by Morris (40), February 20, 1899. Drainage was used. There was some leakage. The patient recovered but the operation was unsuccessful. Healing was defective and a nephrectomy was done 3 months later.

Case 5.—Operated upon by Coe (13), June 3, 1899. Vaginal drainage was used. Leakage was present 1 year later. The patient recovered; result not stated.

Case 6.—Operated upon by Goodhue (23). The patient recovered; result successful.

Case 7.—Operated upon by Finney (6). The patient recovered; result not stated.

Case 8.—Operated upon by Reed (48), in December, 1901. The patient recovered. Four weeks after operation a Harris segregator was passed and urine came from both sides. This was repeated 6 months later with same result.

Case 9.—Operated upon by Johnston (28), October 1, 1902. Vaginal drainage was used. The patient recovered. Function was perfect 29 days after operation.

Case 10.—Operated upon by Graves (24), October 31, 1907. The patient recovered and has remained in excellent health for a number of years.

Case 11.—Operated upon by Doherty (58). The patient recovered; result not stated.

Case 12.—Operated upon by Cobb (12). The patient died from shock.

Case 13.—Operated upon by Cobb (12). The patient recovered; result not stated.

Case 14.—Operated upon by Cobb (12). The patient recovered; result not stated.

Case 15.—Operated upon by Cobb (12). The patient recovered; result not stated.

GROUP IV.—OBLIQUE END-TO-END ANASTOMOSIS

Case 1.—Operated upon by Bovée (9), April 30, 1896. No drainage was used. The patient recovered. Six months after operation a sound was passed; no constriction was found.

GROUP V.—SIDE-TO-SIDE ANASTOMOSIS

(MONARI'S METHOD)

Case 1.—Operated upon by Fournier (19), September 15, 1905. Abdominal drainage was used. The patient recovered. Two months after operation cystoscopic examination showed excretion of urine from repaired ureter the same as from the other ureter.

GROUP VI.—COMBINATION TRANSVERSE END-TO-END AND SIDE-TO-SIDE ANASTOMOSIS

Case 1.—Operated upon by Soresi (55). The patient recovered; end-result, successful.

Bibliography

1. Alksne, J.: Ureternaht und ihre funktionellen Resultate, Folia urolog., 1908–9, iii, 281–340. Animal experiments.

2. Allen, D. P., and Briggs, C. E.: Division of a Ureter with Successful End-to-end Suture of the Same in a Case of Horse-shoe Kidney, Boston Med. and Surg. Jour., 1899, cxli, 344.

3. d'Antona, A.: Di alcuni incidente nelle laparotomie, Arch. e atti della Soc. ital. di chir., 1895, x, 74–77.

4. Blau, A.: Beiträge zur Klinik und operativen Behandlung der Ovarialtumoren, Beitr. z. klin. Chir., 1902, xxiv, 935–992.

5. Blau, A.: Ueber die in der Klinik Chrobak bei gynäkologischen Operationen beobachteten Nebenverletzungen, Beitr. z. Geburtsh. u. Gynäk., 1902, vii, 53–103.

6. Boari: Chirurgia dell' uretere, Roma, 1900, 129–161.

7. Bovée, J. W.: A Critical Survey of Ureteral Implantations, Ann. Surg., 1900, xxxii, 165–193.

8. Bovée, J. W.: The Preferable Method of Uretero-ureteral Anastomosis, Jour. Am. Med. Assn., 1901, xxxvii, 254–256.

9. Bovée, J. W.: Uretero-ureteral Anastomosis, Ann. Surg., 1897, xxv, 51–79.

10. Broun, Le Roy: Discussion of Doctor McLean's article, Am. Jour. Obst., 1910, lxii, 90.

11. Cabot, M.: A Case of Suture of a Divided Ureter. Recovery without Leakage, Boston Med. and Surg. Jour., 1902, cxlvii, 644–646.

12. Cobb: Discussion of Doctor Graves's article, Boston Med. and Surg. Jour., 1917, clxxvi, 149–151.

13. Coe, H. C.: Cases Illustrating Ureteral Surgery, Am. Jour. Med. Sc., 1902, cxxiii, 1–4.

14. Cushing, E. W.: Rare Forms of Myomata, Ann. Gynec. and Pediat., 1893, vi, 277.

15. Davis, B. B.: Treatment of Injuries to the Ureters, Jour. Am. Med. Assn., 1900, xxxv, 1669-1671.

16. Depage, A.: Ureterorrhaphy after Abdominal Hysterectomy, Ann. Soc. belge de chir., 1889, Nos. 5 and 6.; abst., Centralbl. f. Gynäk., 1900, Pt. I, xxiv, 588.

17. Emmet, B.: Injured Ureters in Abdominal surgery; Their Care, with Report of a Case of Anastomosis and Recovery, Am. Jour. Obst., 1895, xxxi, 449–464.

18. Forssell, W.: Eine neue Methode die Enden eines durchschnittenen Ureter zu vereinigen, Centralbl. f. Chir., 1911, xxxviii, 1369–1372.

19. Fournier: Uretero-anastomose suivie de guérison, Cong. franç. de chir., 1906, xix sess., 194–196.

20. Frederick, C. C.: Some Rare and Odd Cases and Experiences in Pelvic and Abdominal Surgery; the Lessons they Teach, Am. Jour. Obst., 1901, xliv, 674–684; also Ibid., 1910, lxii, 91.

21. Fritsch, H.: Ueber die gynäkologischen Operationen des Jahrgangs 1891–2, Berl., 264.

22. Gallet, A.: A Case of Suture of a Ureter, Ann. pub. hosp. St. Jean, Brux., 1898; abst., Centralbl. f. Gynäk., 1898, xxii, 701.

23. Goodhue: Med. News, 1900, lxvi, 1014.

24. Graves, W. P.: Division of the Ureter in Pelvic Operations, Boston Med. and Surg. Jour., 1917, clxxvi, 142–151.

25. v. Gubareff, A.: Ueber ein Verfahren zur Restitution des durchschnittenen Ureters vermittelst direkter Vernähung desselben, Centralbl. f. Chir., 1901, xxviii, 121–123.

26. Hein: J. akuso. i jensk. boliez., 1908; also quoted by Alksne, Folia urolog., 1908–9, iii, 281–340.

27. Hochenegg, J.: Die sakrale Methode der Uterus-Exstirpation, Wien. klin. Wchnschr., 1893, vi, 740, 755, 812, 864.

28. Johnston, G. B.: Uretero-ureteral anastomosis, Am. Gynec., 1903, ii, 18–21.

29. Kayser: Ureterinvagination, Ztschr. f. Geburtsh. u. Gynäk., 1915, lxxvii, 524.

30. Kelly, H. A.: Resection and Anastomosis of the Divided Ureter, Jour. Am. Med. Assn., 1900, xxxv, 860–864.

31. Kelly, H. A., and Bloodgood: Uretero-ureteral Anastomosis, Ureterostomy, Bull. Johns Hopkins Hosp., 1893, iv, 89. Animal experiments.

32. Lavise: Observation d'ureterorrhaphie, Ann. d. mal. d. org. gen.-urin., 1899, xvii, 724–727.

33. Legueu, F.: Suture sur conducteur des plaies de l'uretére, Bull. et mém. Soc. de chir. de Paris, 1917, Pt. 2, xliii, 1951–1952.

34. Mackenrodt: Ureterenplastik: Ztschr. f. Geburtsh. u. Gynäk., 1902, xlvii, 126.

35. McLean, M.: A Method of Anastomotic Repair of the Divided Ureter, Am. Jour. Obst., 1910, lxii, 89, 437.

36. McMonagle, B.: The Management of Surgical Injuries to the Ureters, Tr. Am. Gynec. Soc., 1899, xxiv, 478–510.

37. McMurtry, L. S.: Discussion of Doctor Graves's article, Am. Jour. Obst., 1910, lxii, 91.

38. Markoe, F. H. and Wood, F. C.: Uretero-ureteral Anastomosis for Traumatism, Ann. Surg., 1899, xxix, 693–705.

39. Mathes, P.: Zur Kasuistik der Ureterimplantation in den Darm., Deutsche Ztschr. f. Chir., 1897, xlv, 136–153.

40. Morris, H.: Renal Surgery, 1898, p. 38.

41. Morris, H.: Surgical Diseases of the Kidney and Ureter, 1901, ii, 545.

42. Noble, G. H.: Ureteral Anastomosis, Atlanta Med. and Surg. Jour., 1898–9, xv, 738.

43. Pawlik, K.: Ueber Pseudinterligamentose Eierstocksgeschwülste, Wien, 1891, p. 31.

44. Perlis, W.: Zur Ureterchirurgie, Monatschr. f. Geburtsh. u. Gynäk., 1902, xv, 322–341.

45. Poroschin, M. N.: Injuries to the Ureters during Laparotomy, Russk. wratch., 1897, No. 13; abst., Centralbl. f. Chir., 1898, xxv, 819.

46. Pozzi, S.: Nouveau procéde invagination avec entropion pour la suture bout à bout de l'uretére dans les plaies completes de ce conduit, Assn. franç. de chir. proc.-verb., etc., Par., 1906, xix, 188–192. Also transl. Deutsche med. Wchnschr., 1906, xxxii, 2036.

47. Proust, R., and Buquet, A.: De la technique de l'uretérorrhaphie, a propos de l'extirpation d'un fibrome intraligamentaire, Bull. et mém. de la Soc. anat. de Paris, 1912, 6 s., xiv, 296–302.

48. Reed, C. B.: Ureteral Implantation, Am. Jour. Obst., 1903, xlviii, 378.

49. Robson, A. W. Mayo: Ureteral Anastomosis, Internat. Med. Ann., 1896, xiv, 602.

50. Sadowski: Methods of Suturing Wounds of the Ureter, J. akush. i jensk. boliez., 1904, xviii, 27–32. Also quoted by Alksne, Folia urolog., 1908–9, iii, 281–340.

51. Sawinow: Russk. chir. obos., 1903, vol. i. Also quoted by Alksne, Folia urolog., 1908–9, iii, 281–340.

52. Schauta, F.: Ein Fall von Ureteranastomose, Centralbl. f. Gynäk., 1899, Pt. 1, xxiii, 425.

53. Schopf, F.: Intraligamentäre Ovarienzyste, Ovariotomie, Durchtrennung des Ureters und Vereinigung durch Naht., Allg. wien. med. Ztschr., 1886.

54. Schou: Uretersutur, Ugeskr. f. Læger., 1910, p. 1247.

55. Soresi, A. L.: Une nouvelle méthode d'anastomose des uretéres. La méthode oblique, Rev. chir., 1917, liii, 226–231. Animal experiments.

56. Tauffer, W.: Ueber einige Fragen auf dem Gebiete der Chirurgie der Nieren und Ureteren, Pest. med.-chir. Presse, 1893, xxix, 464–467.

57. Turner, W. K.: Ureteral Anastomosis. Report of a Successful Case, Ann. Surg., 1901, xxxiv, 816–818.

58. Van Hook, W.: Some Points in the Surgery of the Ureter, Jour. Am. Med. Assn., 1895, xxv, 842.

59. Wertheim: Demonstration anatomischer Präparate, Centralbl. f. Gynäk., 1902, xxvi, 1278.

60. Williams, E. J.: Accidental Division of Ureter with End-to-end Anastomosis, Montreal Med. Jour., 1910, xxxix, 685.

61. Winslow, R.: Note on the Repair of Wounds of the Ureter, Ann. Surg., 1898, xxvii, 46–48.

Experiments on Animals

Büdinger, K.: Beiträge zur Chirurgie des Ureters, Arch. f. klin. Chir., 1894, xlviii, 639–682.

Monari, W.: Ueber Ureteranastomosen, Beitr. z. klin. Chir., 1895–6, xv, 734.

Poggi: La guarigione immediata delle ferita transversale complete dell' uretere senza chiusura del canale, Riforma med., 1887, iii, 314, 320.

Reynier, P., and Paulesco: Uretero-anastomose, Bull. et mém. Soc. de chir. de Paris, 1898, xxiv, 117–122.

Tuffier, T.: Etudes experimentale sur la chirurgie du rein. Néphrectomie, néphrotomie, néphrorrhaphie, uretérotomie, Paris, 1889.

d'Urso and de Fabii: Suppl. Policlin., 1898–9, vii, 249.

Van Hook, W.: The Surgery of the Ureter. A Clinical, Literary and Experimental Research, Jour. Am. Med. Assn., 1893, xxi, 911; 965.

Uretero-ureteral Anastomosis with Incomplete Data or Wrong References

Brown, F. T.: Wound of Ureter During Hysterectomy; Anastomosis; Subsequent Nephritis; Nephrectomy, Ann. Surg., 1905, xli, 126.

Durante: Soc. ital. di chir., sess. October 29, 1895.

Estes: Discussion of Doctor Graves's article, Boston Med. and Surg. Jour., 1917, clxxvi, 149.

Garré: Ueber den heutigen Stand der Ureterchirurgie, Verhandl. d. deutsch. Gesellsch. f. Chir., 1909, Pt. I, xxxviii, 27; Pt. II, p. 135.

Gusserow: Charité-Ann., xii. (Wrong reference.) Quoted by Boari.

Monod: Ann. d. mal. d. org. gén.-urin., 1902, xx. (Wrong reference.) Quoted by Alksne.

Nicholson: Am. Jour. Med. Sc., 1902, cxxii. (Wrong reference.) Quoted by Alksne.

Price, J.: Am. Gynec. and Obst. Jour., 1894. (Wrong reference.) Quoted by Alksne.

Reynier: Section et suture de l'uretére, Gaz. d. hôp., 1898, vol. lxxi.

Rochard: Ann. d. mal. d. org. gén.-urin., 1902, vol. xx. (Wrong reference.) Quoted by Alksne.

Tannen: Frommel's Jahresber., 1902. (Wrong reference.) Quoted by Alksne.

Tietze: Centralbl. f. Chir., 1897. (Wrong reference.) Quoted by Alksne.

DISCUSSION ON THE PAPERS OF DRS. MAYO, JUDD AND PETERSON

Dr. Francis R. Hagner, Washington, D. C.—I think the Association is very fortunate in having such excellent papers on these subjects. The work done by these gentlemen is certainly very valuable. We have noticed that a large number of patients having kidney calculi give a history of typhoid. As the urine is so frequently infected in this disease it may have some etiological effect. Pain as a symptom is usually absent when the calculus is fixed in the kidney, but many of these patients complain of frequency of urination and are treated for vesical symptoms when the disease is in the kidneys. If the calculus is movable it will cause intermittent obstruction to the outflow of urine from the pelvis, and consequent colic. As regards the character of the stones that recur, I think we ought to consider that point very carefully. I feel reasonably sure that the oxalate stones and uric acid or urate stones are not so liable to recur as the phosphatic stones. And I think in a large percentage of cases in which recurrence takes place it will be found in patients who have phosphatic stones. These patients nearly always have an alkaline urine, the kidney is more seriously infected and recurrences are more liable to occur.

The use of the *x*-ray at the time of the operation is a very important addition to the technic, as it lessens the liability of leaving stones in the kidney, but, even more important, it lessens trauma of the kidney during operation. Anyone of us who has observed kidneys that have been opened from pole to pole (either at a subsequent operation or at an autopsy) will agree with me. It saves the kidney to make a small opening and remove the stone through that opening.

We recently had an interesting case which I will report briefly. A patient came to us with septic temperature of some

days' duration and a diagnosis of perinephritic abscess was made. He also had pus in the urine from the affected side. The kidney pelvis was injected with thorium, and on observing with a fluoroscope we could see it escaping outside of the lower pole of the kidney into the perinephritic abscess; this condition was borne out at the operation. The *x*-ray catheter is certainly very important in making a correct diagnosis of stone in the ureter, as we have many times seen phleboliths in the pelvis, which are liable to be mistaken for shadows of stone in the ureter and the *x*-ray catheter is employed to great advantage. In the kidney the *x*-ray catheter also gives the location of calculi whether in the upper pole or lower pole or in the pelvis. A blood clot will give the same symptoms as the passage of a calculus, and it is the backing up of urine and consequent distention of the pelvis of the kidney that causes the pain. It can readily be proved by passing the ureteral catheter by the calculus during an attack of renal colic, when we will see the urine squirt out from the pressure, to which the catheter is subjected, and the immediate relief from pain following the disappearance of the urine from the distended kidney pelvis and ureter.

As to the time these cases should be operated upon, we have operated very few in the last two years. We have dislodged nearly all the ureteral calculi by dilatation of the ureter and the injection of certain fluids. It has been our experience in nearly all these cases, if the proper shaped catheter is used, we will be able to get by the obstruction and relieve the back pressure. If, after one or two efforts to get by the ureteral calculus and relieve the obstruction we are unsuccessful, and the patient has evidence of backing up of urine in the kidney, an operation should be performed.

Dr. Robert L. Payne, Norfolk, Virginia.—It is with a feeling of considerable trepidation that I rise, first, to differ somewhat with Dr. Peterson, not exactly in opinion but in experience. A good many years ago I did a lot of experimental work on the ureter, especially in implanting the ureter into the bladder and doing uretero-ureteral anastomosis. We had thirty dogs in which we did an oblique anastomosis, according to Bovée and Weller Van Hook, and end-in-end anastomosis as reported by Dr. Peterson, and end-to-end anastomosis. This is not a differ-

ence of opinion but a difference in experience and results. In the end-to-end anastomosis we got no stricture formation; in the end-in-side or oblique methods of anastomosis there was stricture formation in every instance, and for that reason we have never attempted in the human the type of anastomosis suggested by Dr. Peterson. I have done two end-to-end anastomoses in the human and the results have been like those of Dr. Peterson. I am gratified to know from a study of his case afterward that it showed up so well from the standpoint of stricture and renal function.

Dr. Judd said he did not get any stricture formation following the removal of stones in the ureter. In the same series of experiments, learning that the amount of cicatrix and stricture formation was directly in proportion to the amount of linear scar, whether oblique or not, we carried out a series of experiments in the dog to determine whether stricture formation occurred in the ureter according to the length of the incision. We found stricture formation followed long incision, and the amount was usually sufficient to bring about stricture formation with a longitudinal incision in the ureter when it exceeded one inch.

About five years ago I had a woman upon whom I operated and removed a stone from the ureter. The incision in the ureter was quite long. She got well and was about to leave the hospital when she developed typical attacks of renal colic, and the roentgen ray showed some shadows which we interpreted as phleboliths. To be certain that another stone had not formed a roentgen-ray plate was made with the opaque catheter in the ureter. There was no stone or stones found. These phleboliths were well demonstrated by the opaque catheter. To my surprise there was immediate relief of all symptoms. It was brought to my attention that stricture formation had occurred at this point where a long incision in the ureter had been made.

Following that period I have had 33 cases of stone in the ureter in which I have practised the use of the ureteral catheter or bougie always after the removal of the stone in the ureter before the patient leaves the hospital, and again in the course of a month, if possible, to get the patient to return. Strange to say in the last four weeks I had a woman upon whom I had to do a nephrectomy for hydronephrosis and a tremendously dilated ureter following the removal of a stone in the ureter.

She developed a bad stricture afterward, although a catheter was passed on her before she left the hospital. This stricture was very tight. We did not expect that she would return, but she came back six months later with hydronephrosis and a dilated ureter. I do not know that stricture of the ureter occurs frequently, but it is worthy of consideration, and it is well simply to pass a catheter and guard against it in these operative cases.

Dr. Guy Leroy Hunner, Baltimore, Maryland.—I might begin by discussing the last point Dr. Payne brought up. If the patient had a stricture before the stone, and it bears out what I have been urging in stone in the ureter, we must be careful to have thorough dilatation of the ureter before we finish the operation, dilate upward and downward. If you cut in above the stone, pass the wax-bulb catheter down through the stricture and get it well dilated. I should not think the length of incision in the ureteral wall would make much difference, particularly in those cases that are dilated above the stone.

Another important point, it seems to me, is the fact that we often have two strictures in the same ureter, the favorite locations being where we have two groups of lymphatic glands. In women these occur in the broad ligament or about 3 cm. above the bladder, and a second group occurs 3 or 4 cm. below the pelvic brim at the bifurcation of the anterior iliac vessels. The infection probably first settles in the lymphatic glands and then gets into the walls of the ureter and causes stricture. I find with the wax bulb that a number of cases have two areas of obstruction. The *x*-ray will show a stone in the upper area, and I get the hang at that area and also at the broad ligament area. You may have a stone with a good urinary channel and the symptoms are from the other stricture area, and the removal of the stone does not relieve the symptoms. It is well, therefore, in all cases of stone in the ureter to dilate the ureter both ways, particularly if you have this condition of stone anywhere in the pelvic ureter.

As to the question of the reformation of stones in the kidney. I am convinced that it is often closely associated with the presence of stricture in the ureter. I have had a number of cases that have come back after having been operated on by me or by others; they have come to me with a recurrent stone in the

kidney, and simply by dilating the strictures in the ureter the patient has been relieved and gained in health. In 3 cases of recurrent renal stone due to stasis you can ignore the stones in the kidney if you keep up good drainage in the lower end of the ureter.

Dr. Mayo may disagree with the point I have made that stricture is an important factor in stone formation in the ureter. He apparently argues that if it were a case of mechanical interference with the flow of urine we should find stone in the kinked portion in those cases with prolapse of the kidney and torsion of the ureter by the vessels. I do not agree with that view. The conditions are absolutely different. In his example we have a slight mechanical obstruction without pathologic changes in the ureteral walls; whereas in the case of stricture we have infiltration of the entire wall, and many cases have an ulceration at the site of the stricture. In one out of three stricture cases in which I have resected in doing transplantation to the bladder, there was definite ulceration. In the other two there was flattening of the transitional epithelium such as we find in severe cases of chronic bladder inflammation. We have an inflammatory area interfering with the lumen, and there is a transudation or excess of colloid material or serum, and in many cases actual ulceration and bleeding. Microscopic examination of the urine shows very few red blood cells in many of these cases but this may vary up to the so-called idiopathic hematuria. I am finding that in many cases of idiopathic hematuria, a cure is effected promptly by thorough dilatation of the stricture which probably scarifies and allows the ulcer to heal. We have then a narrowing, a stasis of urine and an inflammatory area upon which stones are prone to form. In the bladder ulcer with deposit of urinary salts there is constant motion of the walls and the breaking off of urinary particles which are passed. In the ureter we have an uneven surface, very much narrowed, with small portions of urinary salts deposited around a little blood clot, or a little excess of serum, ideal conditions for the formation of stones in the stricture area.

Dr. A. J. Crowell, Charlotte, North Caroline (by invitation). —With reference to Dr. Mayo's paper, I will say that there is a great field for research work along the line of stone formation.

However, clinically, I agree with him that infection plays a great part in the formation and reformation of stone. With the idea of preventing their reformation we have lately been irrigating the kidney pelvis with antiseptic and astringent solutions before and following operation in infected cases. We have not kept this up sufficiently long to form an idea of results obtained, but, if it is due to the precipitation and deposition of the chlorides on the debris in the urine, we believe their reformation can often be prevented.

With regard to Dr. Judd's paper, I agree with him in the belief that the great majority of the recently impacted stones, where the lumen of the ureter has not been completely occluded and the kidney function inhibited, that practically all cases can be removed by the use of local anesthetics and dilators. We have removed by this method more than sixty consecutive stones with only two failures. These were cases which came under our care in the beginning of our efforts to remove ureteral stone by this method. We believe that if we had persisted then, as we do now, we would have succeeded. We use novocain and oil in connection with dilatation.

Dr. Richard A. Barr, Nashville, Tennessee.—With reference to the silent stage of stone in the kidney, it will not only last for six days, but it may last for two weeks without any symptoms where there is obstructive anuria. Dr. Frank is not here, but some of you may remember that some years ago he read a paper before the Association in which he detailed some experiments showing that not only was this true, but that if the obstruction in the ureter was relieved within two weeks or perhaps longer (I think sixteen days was the average time) the kidney function would be resumed normally. Of course this silent stage should not be taken by us as encouragement to wait longer than or even as long as six days before operating for obstructive anuria or attempting in some way to relieve it. While the kidney may perfectly resume its function after delay, the earlier the obstructive anuria is overcome the better.

Dr. Willard Bartlett, St. Louis, Missouri.—There is one point in the technic brought out by Dr. Judd which should be noticed. He made the remark that in doing the extraperitoneal

operation it is a simple matter to isolate the ureter. This is so strikingly simple that it should be very well known to those who have not tried it, because one might otherwise be deterred from attempting surgery of the ureter, supposing such a small tube deeply placed is hard to find, which is not the case at all. It hangs to the peritoneum and can be dealt with in such an easy manner as to astonish any one who tries it for the first time.

Another point in the removal of ureteral calculi which Dr. Judd brought out struck me forcibly, that is, a highly developed technic for exposing the point where the stone lies in order to control it and remove it. But I believe a good many of us who are less experienced in this line of work might be more comfortable if we adopted a scheme which is not so highly technical and one which has served me very well in quite a number of cases. It happened that the first stone in the ureter I had to deal with was in a fleshy woman, where I, at least, was almost unable to see the deeply placed site of the lesion at all; I could feel it between two fingers, and feeling it I simply grasped the locality between the thumb and first finger, nicked it on the stone, rubbed the digits together, dilatation of the opening occurred and the stone slipped out. The stone itself was then between the tip of my thumb and my finger. I have not failed to get the stone in that way in many instances where it has been attempted. Where I have gotten the stone filled ureter between the thumb and finger I have succeeded in getting it out. I have never sutured the opening but have never seen but one leak, and that was in the case of the largest stone I ever had. Leakage occurred for a few days and then there was spontaneous closure with an enormous postoperative hernia. My thought has been by doing that way, squeezing the stone through a small hole in the elastic wall of the ureter there will probably be less suturing than if we exposed it and made a larger opening.

Dr. J. Wesley Bovée, Washington, D. C.—I wish to speak only of one point in Dr. Judd's paper, namely, the case in which six days elapsed during which time there was cessation of the passage of urine, and to mention a case reported by Dr. Seth C. Gordon, of Portland, Maine, which is quite unique. One other case has been reported by some one else. Dr. Gordon removed the only kidney, it was found, from a woman and she died thirty-

one days afterward of general progressive asthenia. She never had a convulsion of any sort.

I want to speak particularly about uretero-ureteral anastomosis. This paper that Dr. Peterson mentioned as having been read by me was on the subject of uretero-ureteral anastomosis, and a study of that subject as far back as 1901 led me to read a paper on the subject in which I then collected 33 cases done by the different methods. I came to the conclusion at that time that a transverse end-to-end anastomosis was probably the most satisfactory. The end-in-end method (Paoli) that has been described, and the Mayo-Robson modification of it, which Dr. Peterson did in these cases are also satisfactory, but only 2 cases have been reported. I think Dr. Howard Kelly and Dr. Bache McE. Emmet pointed out that the difficulty was great in applying the end-in-end method of anastomosis because the upper portion of the ureter was much dilated and it could not with facility be drawn into the lower. I agree entirely with Dr. Peterson as to the inefficacy, as a general rule, of Weller Van Hook's method because of the great requirement of length of the ureter to accomplish it, two inches of the ureter being needed to make this anastomosis. If a portion of the ureter had been cut away you can see we would be much handicapped, if we attempted to use that method in preference to one of the others, more conservative as to the length of the ureter.

A feature Dr. Peterson has drawn attention to is that of the subsequent results of these procedures. I think it is very important in all these cases and in all these operations that the patients should be followed up and the ultimate results published. There is apparently some feature of these operations which is not understood and should be investigated more thoroughly, because in those cases in which there is no stricture or a dilatation above the point of operation, as demonstrated by Dr. Peterson in his experimental work on dogs, there may be something in the innervation of these tissues being destroyed which causes paralysis, and therefore this dilatation, and, if it is of such a degree as to give symptoms, and loss of kidney function, it is an important thing for us to know.

Dr. Randolph Winslow, Baltimore, Maryland.—From a limited experience of one case, I published a method in the

Annals of Surgery, in 1897, which is similar to that Dr. Peterson has employed, with the exception that he removed the traction sutures and I did not. I speak of this method because it is neither original with him nor with me. Certainly the end-in-end operation of ureteral anastomosis is a safe and easily applied method, if there is room to make it. Of course, if there is considerable loss of substance it cannot be done, but where there is ample room, it seems to me we cannot have a better method of anastomosis than that of invaginating the upper end of the ureter into the lower end.

Dr. J. A. Crisler, Memphis, Tennessee.—Personally, I want to congratulate Dr. Mayo on the simplicity of his theory of stone formation. It is entirely new to me and is so eminently practical and simple that it carries a tremendous weight from this viewpoint. One can understand how the Doctor has been able to forge so far to the front, when one considers that he uses old fashioned "horse sense" and brings every theory down to a state of fundamental simplicity and clearness. He has probably given us the answer to stone formation within the mucous lined structures, for all time to come.

Regarding Dr. Judd's paper, I am sure we all enjoyed it. I am reminded of a condition that I met some months ago that was very alarming at the time, in the person of a woman in whose right kidney the *x*-ray showed a large stone that had dropped into and occluded the mouth of the ureter. The operation revealed a horseshoe-shaped kidney whose lower half was entirely destroyed by pus, so it was deemed best to remove the organ. Just as this was completed I noticed that a supernumerary ureter arose from the healthy upper portion of the kidney, having a separate pelvis. I feared that the other kidney was absent, even though a competent cystoscopist had successfully passed a catheter into each ureter and succeeded in getting clear urine from both sides, prior to the operation. Imagine my delight several hours later when five ounces of urine were found in the bladder and the patient went on to recovery without incident.

Dr. John T. Moore, Houston, Texas.—I hesitate to take the time of the Association to attempt to explain why it is in

these ureteral anastomoses there is dilatation above the point of union.

In the studies of Keith, of England, and Alvarez, of California, on intestinal physiology, and others who have made similar observations, they find rhythmical action of the intestine is controlled by certain nodal centers. As long as these nodal centers act quietly, and are not interrupted by any obstruction to the nerve supply or musculature of the tube, the rhythmical action is continued from one segment to another. It may be this law applies also to the action of the ureter, because if one has observed the ureter, every now and then he will see this beautiful rhythmical action of the ureter where it passes over a tumor. For instance, you will find the wave passes on down, and you can stop this action at a point, if you catch it with a forceps, interrupt it at that point, and it may pass on. If you cut the ureter you have interruption of this nerve supply with the musculature so that action goes on down the tube to this point, and, until the nerve supply is again established at either end with the musculature, you have an interruption of this rhythmical action.

Dr. Judd (closing the discussion on his part).—Regarding the question of anuria, I want to mention 2 cases we had of calculous anuria, and an interesting point to me is that these individuals did not appear to be sick at all; they were not passing any urine; but they had no other evidence of being sick.

Regarding stricture of the ureter, in our series of 400 patients 289 of which we have been able to follow, 72 had pains after operation which we think may have been due to stricture, although in only 8 cases were the pains in the region of the stone. Other cases apparently had no sign of trouble at all after removal of the stone. Of the 21 cases, some had pain enough to require morphin, and such a plan as that suggested by Dr. Payne would be a very fine thing for these few cases. However, I think in all the cases at the end of six months following operation the pain subsided, and only two of them had special treatment.

I think Dr. Bartlett's description of the technic would be useful, and as a matter of fact, we have employed that technic in all the cases where we can catch the stone between our fingers and press it out through a small opening in the ureter.

I want to mention a case similar to the one Dr. Peterson operated on. I completely severed the ureter during a pelvic operation, did an end-to-end suture, and the point I want to make is that after suturing the ureter I wrapped the sutured ureter up completely with a band of peritoneum which I thought was quite a useful thing. At any rate this patient was followed for severa months, the ureter catheterized and the patient was found to have a good functionating kidney six months after the anastomosis.

Dr. Peterson (closing the discussion).—My paper unfortunately is too long to read or even to abstract in the time allowed. The tables and the collected cases will be found in the body of the paper. It was my purpose in the paper to study end-results after uretero-ureteral anastomosis. Alksne from extensive experimental work arrived at the same conclusions stated by Dr. Moore, that whenever a ureter is severed, the blood or nerve supply is so interfered with that dilatation above the point of anastomosis will result. My plea is that every case of uretero-ureteral anastomosis should be demonstrated, so far as results are concerned, by modern methods. Even if a certain degree of dilatation follows ureteral anastomosis, no matter how perfect the surgical result may be, it does not follow that the operation should be abandoned. Even a kidney which does not function perfectly is far better than no kidney at all. Above all we ought not to report a patient after uretero-ureteral anastomosis as cured until the integrity of the ureter has been demonstrated.

AN EFFICIENT TREATMENT FOR CARBUNCLES

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A carbuncle is a staphylococcic infection involving all the layers of the skin and subcutaneous tissues. It may extend through the subcutaneous tissues to the underlying fascia, which sometimes it may penetrate, and extend well into the muscular tissues beneath. Though primarily a staphylococcic infection it may be mixed with anthrax bacilli or streptococci, and not infrequently a very virulent aspect may thus be assumed.

A boil or furuncle differs from a carbuncle in its circumscribed character. It is a more restricted or isolated focus of infection. It sometimes presents a higher range of temperature, but not so much constitutional depression, and does not endanger life as does a carbuncle.

A carbuncle presents more than one point of infection contiguous to or near the original focus, showing multiple heads and a marked tendency to spread beneath the surface. Probably its tendency to spread beneath the surface is due to abnormally low resistance of the tissues involved. Carbuncles have shown a preference for persons of lowered resistance, especially above fifty years of age, and for persons suffering from diabetes mellitus, Bright's disease or alcoholism. When a carbuncle is located on the face, particularly when it is upon the upper lip, it may present a most formidable character, and, owing to the frequent extension of infection from the lip to the meninges and brain, it has resulted in an extremely heavy

mortality. Some observers place this mortality as high as 50 per cent. Indeed, carbuncles are so frequently fatal and often so very troublesome that one may well be surprised that its treatment has received so little serious attention. We find modern text-books upon general surgery still giving the same old advice about crucial incisions, curettement of dead tissues and the application of carbolic acid and other antiseptics. Excision of carbuncles is cautiously referred to and the application of a Paquelin cautery is mentioned as a possible resort by only one or two modern text-books of the many we have examined. Bloodgood, however, writing upon the subject of infections (*Progressive Medicine,* December, 1914), mentioned the use of the cautery for burning out the center of carbuncles as having some advantage over excisions. The subject of carbuncles is given negligible attention in current literature.

Ten years ago the writer read a paper at the Texas State Medical Association, meeting at Amarillo, entitled "The Sterilization of Cancer," in which he contended that cancer is probably a bacterial or parasitic disease, and when accessible should be excised with a cautery and the remaining surfaces sterilized by intense heat, leaving no raw, bleeding or abraded surface to be contaminated or to invite infection by any living organisms which might remain in the vicinity of the wound.

The principles pertaining to the use of intense heat promulgated at that time for the sterilization of cancerous tissues have in recent years been practised in various ways by many of the world's ablest surgeons. The practice as outlined and reported then has been to us satisfactory beyond our most sanguine expectations. It has been amplified and extended at our clinic until it has become more or less standardized.

Five years ago it occurred to us that a carbuncle, being a bacterial disease of a localized and destructive character, might readily respond to the same type of sterilizing operation as that so satisfactorily applied to all superficial cancers. We had previously observed the slow uncertain results from incision and curettement and also the occasional appalling hemorrhage and shock from total excision of large carbuncles in very much

debilitated subjects. We then began the use of the Paquelin cautery, which was succeeded later by the Percy cautery and more recently by a large electrocautery knife with such splendid results that we have now adopted this as a regular treatment for carbuncles.

Very small carbuncles, located about the face and neck where the cosmetic result is important, should be punctured near the center by a red-hot cautery. By swinging the cautery handle around in a circular manner the cautery tip or knife should penetrate the subcutaneous tissue, excavating back beneath the skin's surface, sterilizing each tiny pocket without destruction of the entire skin surface. During this procedure the pus pockets are recognized by a hissing or sizzling sound, due to the emission of steam. This results from boiling pus. Cessation of the emission of steam is an indication that the pus limit has been reached and the tissue in that direction may be considered sterile. A complete circuit of a small carbuncle can be thus made in a few seconds. Penetration of the cautery into the subcutaneous fat may cause a frying, sputtering sound, which should not be confused with the emission of the steam when pus cavities are entered.

When a carbuncle is located upon the back, shoulder or nape of the neck, or when it has gotten under such headway as to endanger the patient's life, no such effort at conservation of the skin, as above described, should be practised. Instead the entire carbuncle mass should be marked off or outlined by the cautery penetrating the skin just outside of the suppurating margin, found usually at the junction of the dark-hued with the bright red skin, and complete excision should be made. After the cautery has penetrated the entire thickness of skin and entered the fatty tissue below, making a channel entirely around the carbuncle, the edges of the mass should be grasped at one side by three or four mouse-tooth forceps, which serve as tractors. By strong traction the mass is lifted out of its bed while the cautery sweeps back and forth between it and the cellular tissue below or skims along the fascia covering the muscle beneath or penetrating muscle, if necessary, until the

entire mass is freed. Should any vessels spurt freely or fail to close when the dark red cautery is held in contact with them a few seconds they should be at once seized with mouse-tooth hemostats and later ligated, if necessary. A touch of the cautery for a few seconds to the end of the hemostat while in place will often render ligature unnecessary. Any doubtful places beneath the remaining skin margins should be explored by the cautery tip. If the emission of steam is noted it should be applied until the cavity is apparently dry. Such a wound is now sterile and may be handled as any sterile burn. Dakin's solution may be used to advantage to keep the wound sterile and hasten the preparation for skin-grafting. As soon as all burned tissue has been cleared away perforated skin grafts sufficient to cover the granular surface soon completes the cure.

The conclusions reached by us are based upon the observation of 32 cases of carbuncle treated by the application of the cautery as herein described. Compared with former experiences the period of convalescence appears to be conservatively 50 per cent. less than by the old methods of treatment.

In one of our face cases involving a large part of the cheek and the temple it was necessary to apply the cautery a second time for a small extension of the infection in the temporal region, due doubtless to the fact that the edges were not sufficiently undermined and explored with the cautery tip at the primary operation. This case, however, had been treated by incision three times before he came to the hospital. One case exhibiting, upon entrance, evidence of septic pneumonia had a carbuncle extending across the back of the neck from one sternomastoid muscle to the other. Immediate cautery excision was done under nitrous oxide anesthesia without marked shock or depression. This patient, however, seven days later died from the pneumonia. Another case, a man, aged seventy-six years, had a large carbuncle on the back which was excised by cautery without shock or constitutional disturbance. While convalescing he developed a small carbuncle on the sacrum thirty-six days later. This was removed in the same manner. Two weeks after the second operation, while convalescing satis-

factorily and sitting in a wheel chair, he had a stroke of hemiplegia, from which he died in ten hours. All the remaining cases recovered promptly without any complications or symptoms worthy of note.

Crucial incisions, curettage, the application of carbolic acid and even excision by knife very frequently fail to reach all foci of infection. Knife excision leaves a large contaminated raw surface favorable for further absorption and extension of infection. The hemorrhage from excision of a large carbuncle may be the determining factor against the patient's recovery. The popular methods of treatment are more painful, more depressing and much slower in their results. The patient continues to have pain, fever, loss of sleep, loss of appetite and often requires repeated incision, painful local treatments and excessive use of opiates, until fairly exhausted. Even when a fatal issue has been averted recovery from large carbuncles so treated is exceedingly slow.

In marked contrast with these results, when radical cautery treatment is adopted, is the sudden cessation of pain and fever. Often the patient expresses wonderful relief from pain soon after he arouses from the anesthetic. The temperature in mixed infection cases, though often 100° and 103° or 104° at the time of operation, drops to normal or very nearly normal in a few hours, and may remain without appreciable rise during the entire convalescence. The appetite quickly returns. The patient sleeps without opiates and has a comparatively comfortable and early convalescence. When it is remembered that carbuncles are most frequently found in old people or people whose resistance has been greatly reduced by diabetes or other disease, we believe every reasonable precaution should be made to stop the infection quickly and turn the tide in a safe direction.

Sterilization of the lesion by cautery is specific and dependable. There is no marked loss of blood. The immediate closure of lymphatics and all capillary bloodvessels renders further absorption of the products of the infection impossible. The immediate cessation of pain, disappearance of fever and

FIG. 1.—An advanced carbuncle. The outer limit to the pus pockets is usually found at the junction of the dark red with the bright red areola.

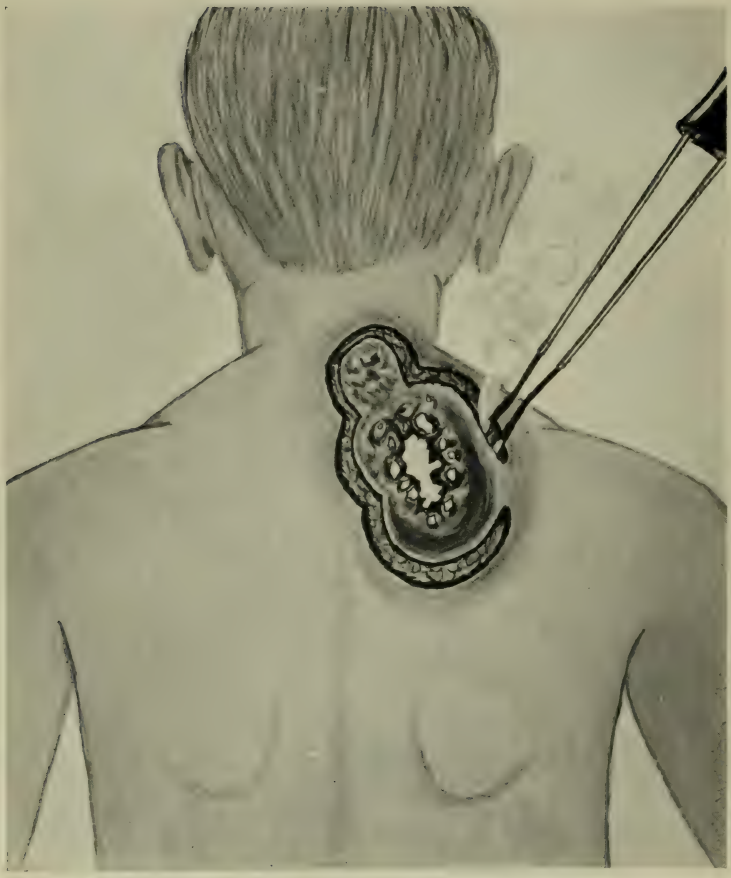

FIG. 2.—The cautery is made to penetrate entirely through the skin into the areola tissue beneath.

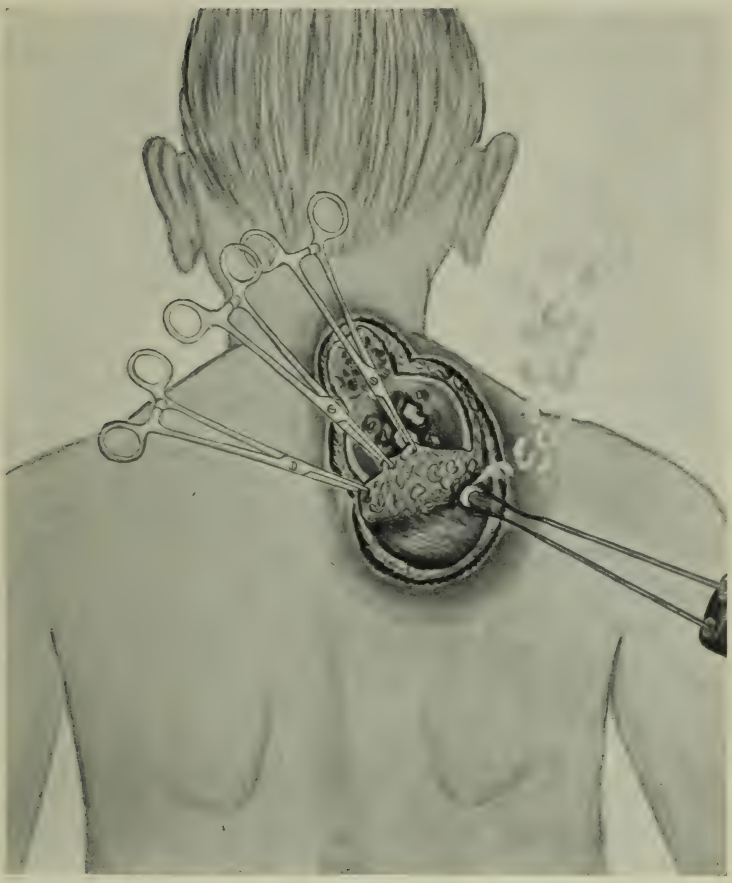

FIG. 3.—With mouse-tooth forceps the skin margin of the carbuncle is lifted up while the cautery sweeps back and forth beneath its surface until the entire mass is excised.

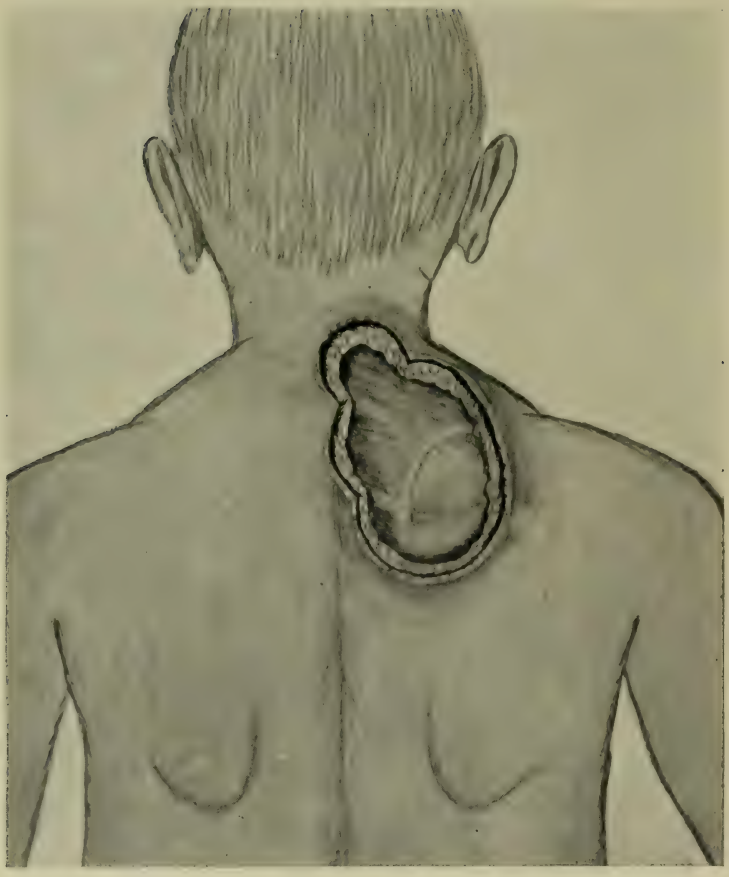

FIG. 4 — A clean, sterile, safe excavated wound is substituted for a dangerous local infection.

prostration, the quick return of appetite and peaceful sleep, and in the absence of other fatal disease the almost certainty of recovery, are in such favorable contrast with cases treated by other methods that we believe this method of treating carbuncles should be habitually given preference.

DISCUSSION

Dr. Robert Carothers, Cincinnati, Ohio.—I cannot find one bit of fault with Dr. Scott's method of treatment, particularly when he refers to radical methods of treatment; but, if one studies carbuncle and what nature does, he will find that nature places a stone wall around the carbuncle. Underneath the carbuncle we have the deep fascia. I am going to differ with the doctor in one point. I think it is almost never that a carbuncle goes below the deep fascia, if it ever does. We have the deep fascia beneath; we have this stone wall on the outside. Every effort in treatment should be to prevent the breaking through of that stone wall, because that is nature's effort to keep the thing local and not let it get into the system.

What are we going to do? We are going to treat these cases either palliatively or radically. I have seen several hundred cases of carbuncle, and I have had the most excellent results from the palliative treatment of equal parts of castor oil and turpentine. Sometimes that solution varies a little—a little more turpentine, a little less castor oil; but more frequently it is more castor oil and a little less turpentine. It acts beautifully. It will relieve pain. It does not disturb nature's effort at what it is trying to do. Castor oil is the most penetrating oil on earth. It goes everywhere, and carries with it turpentine. It is the only oil that goes through blue mud. The pus comes out; the carbuncle is lifted out most beautifully. In cases in which you have decided you cannot do operative measures, try this and you will not be disappointed. If we are going to do anything palliative, I think this method is most excellent. There is one thing I would condemn most forcibly, and that is the use of the

crucial incision. If you are going to stick a knife into a carbuncle you are going to have trouble. If you use a knife, go entirely outside of the stone wall and get the carbuncle and everything out; but if you are going to do a radical operation, it is either the one mentioned of burning it out in the center, which is an outside operation, or doing the operation which Dr. Scott suggests, and which I have done.

Dr. Alexius McGlannan, Baltimore, Maryland.—Beginning with Dr. Bloodgood's observation of burning into the center of a carbuncle, we have gradually extended the cautery operation until now it is the only operation we think of in dealing with carbuncles. Our operation is about as Dr. Scott has described. At operation, under nitrous oxide anesthesia, we go farther than Dr. Scott does; we make an incision well out to the edge of the indurated area. Unless we did this we found there was a large number of cases, certainly 25 per cent., in which it was necessary to do a secondary cautery incision to get rid of the abscesses beneath the indurated area. In the beginning now we take out the indurated area, including the active suppuration. We never go through the deep fascia. If there is any question in our mind about the deep fascia we leave the posterior wall of the carbuncle and depend upon sterilization by heat to kill the organisms in the deeper portion. Roughly, we can think of the operation as a *débridement* with the cautery, and the result of the cautery incision has been the same as the excision of infected tissue in war wounds. Patients are relieved of their septic symptoms; the wound takes on healthy granulation, and it is seldom necessary to do skin grafting even after tremendous excisions of the neck and shoulder. For example, in an excision extending from one mastoid process to the other, and from the hair line to the seventh cervical, taken out in one piece, the wound will granulate rapidly and in the end you may, skin graft an area the size of a silver dollar.

Dr. Joseph Ransohoff, Cincinnati, Ohio.—I have seen some excellent results from what we call the Cincinnati method of treatment of carbuncles. The method was devised in Cincinnati. I do not believe in the stone wall idea, because if the process is active at all we would never get through it. If it is a stone wall

it is decidedly reticulated, like a piece of china plate. The edge is decidedly reticulated and things get through the reticula. This method of removing carbuncles, which I would call an enormous plunge over pus pockets, is not particularly new. It is not new to remove a carbuncle by means of the cautery.

I would disagree with the essayist about large carbuncles. I have never seen one go beneath the deep fascia. I have seen many of them. In making a large excision you leave an enormous burnt area that granulates over slowly. Objection has been made to the crucial incision. There is absolutely no objection to making a crucial incision with the thermocautery and removing the skin from the carbuncle itself and turning over four flaps of skin just as you would get an orange out of its peel and get the whole thing out *en masse*. A good deal of the skin will slough and some of it will live, and the more of it that lives the less will be the period of convalescence.

I agree with the last speaker (Dr. Carothers) that skin grafting is hardly every necessary. When we have a granulated wound of any kind and expose it long enough to electric light rays it fills up; you see it overnight. I have seen very large carbuncles granulate over and epithelialize very rapidly. I have hardly ever seen a case in which skin grafting was necessary. I would suggest in making a crucial incision with the thermocautery that you turn over a four-sided trap-door and get the carbuncle out just as you would an orange out of its peel.

Dr. Scott (closing the discussion).—I am glad to hear an expression of opinion about the depth to which a carbuncle may go. While this series of 32 cases represents the number we have handled since we began the use of the thermocautery, our experience covers a more extended period, in which we have had many cases of carbuncle. In all my experience I know of but two cases in which carbuncles penetrated the deep fascia. I recall one of them definitely which was on the shoulder and the other, I think, was on the back of the neck. It was while working with the cautery in the former case that I discovered this fact. The skin was unusually dense and the pus had gone through the fascia at the point not larger than five-cent piece, but when it once got through it burrowed into the muscular tissue beneath the fascia, forming a pocket. I followed it with the cautery, sterilizing it,

and removed much of the deep fascia covering the muscle to expose properly the bottom of the pus cavity. I think it is a very uncommon thing for a carbuncle to perforate through the deep fascia. I have had no experience in the treatment of carbuncle with the use of castor oil and turpentine. After so long a time a great many patients recover from carbuncle following the use of most any sort of local application, and the same may be said about the usual form of surgical operaton. I hesitated to bring this subject before the Association, but when I recalled the fact that so many competent physicians and surgeons still make use of local applications and inefficient operations, and that so often patients eventually die when dilatory methods are used, I felt justified in presenting to you a method which acts promptly and with certainty. I do not know of anything, in a surgical way, that is so specific as the application of the cautery to a large localized infection, whether it is a carbuncle, tubercular infection, cancer, anthrax or whatnot.

A SUCCESSFUL POSTERIOR GASTRO-ENTEROSTOMY SEVENTY-SIX HOURS FOLLOWING A RAMMSTEDT WHICH FAILED TO RELIEVE THE OBSTRUCTION

By Frank D. Smythe, M.D.
Memphis, Tenn.

J. E. McC., male, aged eight weeks. The infant was breast-fed until it began to vomit during nursing, or a short while thereafter, which was on the fourth or fifth day. The infant at birth weighed 8½ pounds. It was a vigorous child and appeared to be a perfectly healthy one. The mother experienced a normal labor and her health was good during pregnancy until the sixth month, when she had influenza and was seriously ill for many days. With very few exceptions hers was the only case of advanced pregnancy in Memphis developing influenza that did not die. This is the second child; the first is a healthy girl, six years of age. For five days there was absence of evidence of trouble of any kind. On the fourth day vomiting occurred two or three times during the day; sometimes the child would vomit while nursing and at other times vomiting occurred several hours thereafter. Constipation existed from the outset. Vomiting increased in frequency as time passed, and there was never any evidence of infection.

The infant was removed from the breast and artificial feeding substituted for mother's milk. There was no improvement in the condition as a result of the change of diet. The diet and medical treatment were changed from time to time, and it was believed that some improvement would result from some of the

changes made. The apparent improvement was of short duration. A constant downward tendency from the outset, with progressive loss of weight, was evident, though the patient remained bright and fairly vigorous, notwithstanding the fact that everything given him by mouth was vomited after the first two weeks. The vomiting was at all times explosive in nature, never the regurgitant type observed in infants when their stomachs are overdistended.

I was called to see the case with Dr. Eugene Rosamond, pediatrician, who saw it for the first time the same day. He made a diagnosis of pyloric obstruction. Dr. J. B. McElroy saw the case in consultation. Dr. McElroy and myself concurred in the diagnosis made by Dr. Rosamond and agreed that immediate operation was imperatively demanded. The infant was emaciated to an extreme degree. It weighed less than five pounds, and its wrinkled face and body gave it the appearance of a diminutive nonogenarian. The diagnostic symptoms described by Dr. Downes, with the exception of the preoperative detection of the tumor, were all markedly in evidence in this case: projectile vomiting, tumor, peristaltic waves, gastric retention, rapid loss of weight, also the history of obstinate constipation. A few small particles of undigested milk were observed in the occasional fetid stools.

The patient was despatched to the hospital with as little delay as possible and the operation performed at 11 o'clock Monday morning, March 31, 1919. Ether was the anesthetic agent used. The peritoneal cavity was entered through an incision which was made to the right of the median line, 3½ inches in length (epigastric region). The stomach was enlarged, ballooned; there was considerable edema of the pylorus. The liver was large and projected downward, overlapping the pyloric extremity of the stomach. A tumor resembling in size, shape and color a spring onion was found. The tumor of the pylorus was grasped between the index finger and thumb of the left hand, and a longitudinal incision, dividing the circular fibers around the pylorus down to the mucosa, was made. The tumor consisted in an enormous increase in the circular fibers.

The mucous membrane dilated and bulged immediately, practically filling the incision. The muscle fibers were further separated by the use of a pair of dissecting scissors. Near the duodenal end of the incision the coats of the intestines were very thin and a small perforation occurred at that point during the stretching of the incised circular fibers; the perforation was closed with two catgut sutures. No other measures for the purpose of additional protection were resorted to and the operation was hastily finished. Time required from start to finish was about ten minutes, and the patient's condition at the conclusion of the operation was as good as it was when placed upon the table.

Two hours after the operation a small quantity of a solution of sugar of milk was given by mouth and repeated at intervals of an hour, with the addition of a small quantity of milk from a wet-nurse. The nourishment administered was retained for four hours and then vomited. Vomiting of everything that was given continued henceforth as before the operation was performed. Soda bicarbonate, with glucose in salt solution, was administered per rectum. A 4 per cent. solution of glucose was used subcutaneously. Feeding by mouth was discontinued for six hours, when the sugar of milk and milk from the wet-nurse was again resorted to by mouth, with the same result as before. There was noted in the patient's condition but little change, except a rapidly growing weakness for the forty-eight hours after the operation had been performed. The temperature was now 104°, respiration 46, pulse 160 and almost imperceptible. No one expected the child to survive the night. We were convinced that the obstruction of the pylorus had not been relieved by the operation, and it was absolutely out of the question to do a gastro-enterostomy at this time with the remotest hope of the patient surviving the operation (Figs. 3 and 4).

Thursday morning the patient's condition had improved somewhat, though it was desperately ill, almost exhausted; nevertheless we decided to reënter the abdomen and relieve the child, if possible, by doing a gastro-enterostomy. With the

assistance of Dr. Robin Mason and Dr. Frank W. Smythe a posterior no-loop gastro-enterostomy was performed as quickly as possible. There was no evidence of peritonitis or trouble of any kind resulting from the Rammstedt, performed seventy-six hours before. The pyloric extremity and a considerable portion of the stomach were markedly edematous. The obstruction was complete; nothing could pass the pylorus, owing to the edema. The time required for the performance of the operation and to get the patient off the table was eighteen minutes. The patient was conveyed to its room in the arms of the nurse apparently more dead than alive. It was the most unpromising case I have ever seen put upon an operating table.

Within forty minutes after completion of the operation sugar of milk in solution was administered by mouth. Dr. Rosamond superintended the preparation of the nutrient fluids, giving this most important subject his constant attention, and much credit is due to him for the successful outcome of this case. Fluids given by mouth were retained for twenty hours, and then a large quantity of fluid was vomited. The stomach was immediately washed out and within two hours' time breast milk and condensed milk were given and there was no further trouble. The child did not vomit again during its stay in the hospital. The wound healed promptly and the patient left the hospital two weeks after the operation, retaining and digesting its nourishment well, improving in appearance and gaining rapidly in weight.

It has now been seven months since the operation was performed and it will be seen from the picture thrown upon the screen (Fig. 7) that the baby is a good specimen of health and vigor. He weighs 19½ pounds stripped, which is the average weight for a healthy male child of his age, and he is apparently none the worse as a consequence of the stormy career experienced during the first eight weeks of his life. This case is unique; there is no report of a similar case; that is where a Rammstedt operation had been performed and failed to relieve the obstruction, followed by a gastro-enterostomy

seventy-six hours thereafter as a *dernier resort* upon a child whose life was almost extinct, with the hope of compensating for the unrelieved obstruction of the pylorus. I have investigated the literature at my command and communicated with Dr. William A. Downes, who has had the largest experience with this type of cases of any surgeon. Dr. Downes wrote me, July 11, the following letter: "My dear Dr. Smythe: I was very much interested to hear of your experience with the Rammstedt operation. I know of no similar case recorded in the literature. Early in my experience with the Rammstedt operation I had one case in which a gastro-enterostomy would have undoubtedly saved the child, as the obstruction was due to a tumor in the lumen. However, I did not appreciate the condition soon enough. We continue to be pleased with the results of the Rammstedt operation, which now number 175. I hope to make a full report of these cases some time this winter. With kindest regards, I am, very truly yours, Wm. A. Downes."

The Rammstedt operation has proved successful in relieving the obstruction in about 75 per cent. of cases thus treated. Dr. Downes reports to me in a personal letter that the last 28 cases operated upon by himself were followed by a mortality of 7 per cent., which is the highest percentage of successful operations in any series of cases with which I am familiar. The operation is comparatively simple, and on account of the ease with which it can be performed it is now and will probably remain the method of choice of operations for relief of pyloric obstruction. It requires but a few minutes to complete the operation, not more than ten in uncomplicated cases, and there is no hemorrhage or shock experienced incident to the operation; the patient leaves the operating room in about as good condition as before the operation was performed.

It is not my wish at present to direct your attention to the relative merits of the Rammstedt operation and gastro-enterostomy (for information on that subject you are referred to the statistics compiled by Dr. Haggard in an article which he read before the Southern Medical Association in Memphis,

1917, which appeared in the *Southern Medical Journal,* July, 1918, vol. 11, p. 506), but to report a case in which a Rammstedt operation failed to effect a cure, and the patient's life was saved by correctly interpreting the pathology responsible for the persistent vomiting by the immediate performance of a gastro-enterostomy. Since having operated upon this child, and witnessing its recovery, I cannot conceive of a degree of exhaustion, starvation and weakness, the result of pyloric obstruction, that would contra-indicate gastro-enterostomy in which a Rammstedt operation had been performed without relieving the trouble, provided I was convinced that the failure was due to the unrelieved obstruction.

I have with me some slides of cuts, some drawings and radiograms which will add to the interest of what has been said. Some of the cuts are taken by permission from the *Transactions of the Southern Surgical Association,* vol. 28, p. 176 (Fig. 1), and from an article by Dr. Gavin, deceased, vol. 24, p. 101 (Fig. 2). Dr. Coleman Burns, of Memphis, made the drawing which shows the posterior gastro-enterostomy performed upon my patient (Fig. 5). Dr. L. H. Chapman took the roentgen-ray pictures (Fig. 6) after administering a barium meal, thus enabling me to present the evidence that while the Rammstedt operation was primarily a failure in relieving the obstruction of the pylorus, it was ultimately a success. It is seen that the entire contents of the stomach pass into the intestine through the pylorus and that no barium escapes from the stomach through the gastro-enterostomy opening. The fate of the posterior gastro-enterostomy is again demonstrated in the absence of exclusion of the pylorus or an unrelieved obstruction, and that within a short while all food and drink entering the stomach escapes from that viscus in a normal manner, just as if the operation of gastro-enterostomy had never been performed; again reminding us that gastro-enterostomy is contra-indicated in the absence of obstruction of the pylorus, for the reason that the contents of the stomach will circulate in accordance with Nature's method where the pylorus is patulous. The proper treatment for congenital

FIG. 1.—First step of Rammstedt operation. Tumor supported. Line of incision shown. (Copied by permission from the Transactions of the Southern Surgical Association, vol. xxviii, p. 176. Technic of operation identical.)

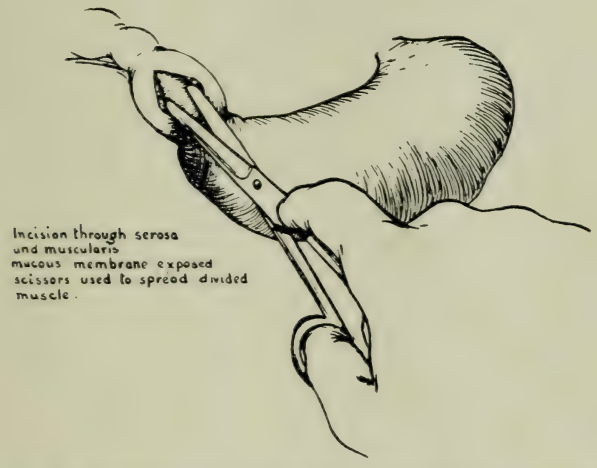

FIG. 2.—Second step in my case the same as above. (Copied by permission, from the Transactions of the Southern Surgical Association, vol. xxiv, p. 101.

Fig. 3.—A kodak picture of the infant taken on the morning before the second operation. The picture is not clear, but sufficiently clear to show the marked degree of emaciation present.

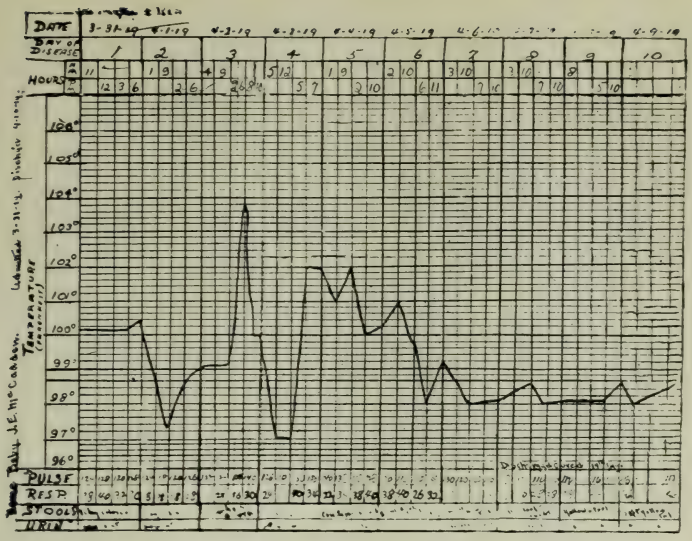

FIG. 4.—The temperature chart following the Rammstedt operation. The gastro-enterostomy was performed on the fourth day and the child's temperature was 102°.

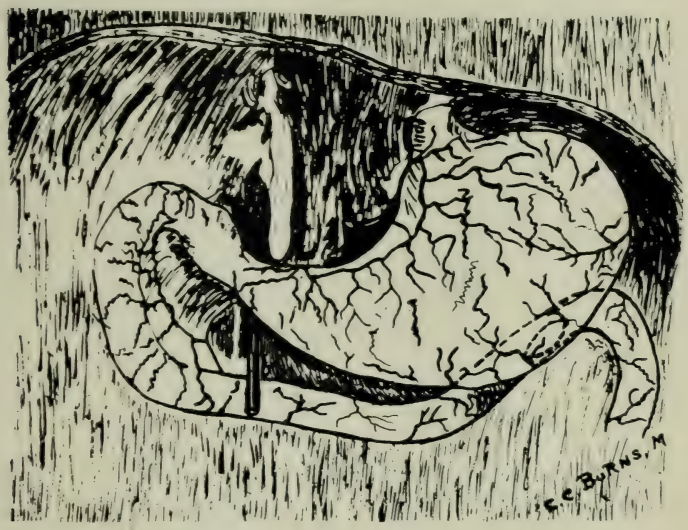

FIG. 5.—Shows the point of anastomosis between stomach and jejunum. Posterior gastro-enterostomy was performed the third day after a Rammstedt had been done upon the same patient. The drawing is by Dr. C. E. Burns.

FIG. 6.—Radiogram taken ten minutes after ingestion of a barium meal. It is seen that all of the salt is escaping from the stomach through the pyloric orifice as though the gastro-enterostomy had not been performed. This experiment was conducted seven months after the operation. A second radiogram was taken four hours after ingestion of a barium meal, showing the stomach had completely emptied itself of the barium. Having lost the photograph it is impossible to supply it at this time.

FIG. 7.—Photograph of the patient seven months after operation. He is free from local disturbance and is of the average weight of a normal male child of his age.

hypertrophic stenosis of the pylorus is to do a Rammstedt operation at the earliest moment possible after the diagnosis is made. The mortality in that event would prove very low, probably not over 4 or 5 per cent.; late cases will ever be attended by a high mortality rate because of exhaustion from starvation.

From the foregoing experience I am warranted in submiting for your consideration the advisability of resorting to posterior gastro-enterostomy as a last resort in a case, or cases, having recently undergone a Rammstedt operation resulting in failure to relieve the obstruction, and we are justified in assuming that the operation has failed when the symptoms persist for two or three days after the operation has been performed. I do not know what percentage of patients dying following a Rammstedt operation is due directly to failure in relieving the obstruction, but I do know that whatever the percentage may be they should be given the benefits offered by a gastro-enterostomy; and I believe that the surgeon adopting this policy will be agreeably surprised at the result of his efforts and that otherwise hopeless cases will be saved.

The pyloric extremity and the stomach should be very carefully palpated and inspected, and should grave doubt exist as to whether the Rammstedt operation will relieve the obstruction within due time, a Rammstedt operation should be performed, followed by a posterior gastro-enterostomy, thus assuring the patient the certainty of relief from the obstruction and obviating the necessity of a secondary operation which had to be done in the case reported.

ILEOSTOMY FOR POSTOPERATIVE OBSTRUCTION FOLLOWING APPENDECTOMY

By Edward P. Richardson, M.D.
Boston, Mass.

Enterostomy is justly regarded, in cases of acute intestinal obstruction coming on spontaneously, or months or years following laparotomy, as an evil often necessitated by the nature of the obstruction or by the patient's condition at the time of the operation. It may be a life-saving measure; nevertheless, the ideal procedure is to discover and deal with the point of obstruction.

In considering the treatment of intestinal obstruction, however, a distinction should be made between obstruction occurring spontaneously, or late after operation, and that occurring early after operation, during the period of convalescence, the type described by Deaver as postinflammatory obstruction. Although commonly grouped together in statistics they differ both in pathology and in prognosis. In the first class, consisting of spontaneous and late postoperative obstruction, we are dealing with a wide variety of pathological lesions, including firm organized bands and adhesions. In the second class, cases recently operated upon, the pathology is less uncertain. If mechanical obstruction exists, in the majority of cases it is caused by recent unorganized or partly organized adhesions, which present a greater hope of yielding or absorbing. Such adhesions represent temporary rather than permanent causes of obstruction. If we further limit this second class of cases to its largest group, obstructions occurring during convales-

cence from appendicitis, the probable pathological cause is even clearer. Here in all likelihood the cause of obstruction is adhesions of the lower ileum in the neighborhood of the original wound, right iliac fossa or pelvis, with local paralysis of a segment of bowel from sepsis as a possible contributing factor. We can further say that a strangulation of a loop of bowel is unlikely.

With the clearer estimation which is possible as to the character of the obstruction, and its less permanent nature, the place of enterostomy in treatment is distinctly different in obstruction during convalescence from its place in the treatment of obstruction in general. In this connection, since more radical measures are frequently advocated for this condition, particularly ileocolostomy, it has seemed worth while to record the result in seven cases of obstruction occurring during convalescence from appendicitis, representing my total experience to date and including five cases in which ileostomy was done.

While symptoms of ileus, occurring shortly after operation for gangrene of the appendix, with abscess or diffuse peritonitis, are common, clear-cut mechanical obstruction is infrequent. Vomiting, distention and obstipation, developing immediately after operation, characterized by absent or greatly diminished peristalsis and gas pains, are principally the result of peritoneal infection and represent conservative efforts on the part of the individual to limit the sepsis. In such cases treatment well directed toward aiding and maintaining the patient —Fowler position, proctoclysis with tap water or glucose solution, hypodermoclysis, gastric lavage, morphin, hot-packs of the abdomen, enemata, pituitrin, etc.—affords relief in the majority of cases. The outcome depends chiefly on the ability of the patient to overcome the infection; if this occurs the bowel usually takes on its activity. In considering operation in relation to these cases I have felt that there was little to be gained by it unless there had been evidence of active peristalsis.

In a few cases of paralytic distention, although the patient appears to overcome the peritoneal infection within the first three or four days and peristalsis becomes active, with gurgling

on auscultation and definite gas pains, yet distention and vomiting persist. Enemata occasionally give rather unsatisfactory results; occasionally the obstruction appears complete. In such a patient, who is rapidly losing ground in spite of appropriate palliative measures, surgical interference comes in question. These cases cannot be considered as pure mechanical obstruction; nevertheless there is a definite mechanical factor in addition to the sepsis (Cases 5 and 7).

In other cases the distention and discomfort following operation subside and the patient is apparently making a satisfactory convalescence. Toward the end of the first or during the second week, pain suddenly develops, followed by vomiting, distention and evidence of increased peristalsis. Enemata become ineffectual. Acute mechanical obstruction has obviously occurred (Cases 3, 4 and 6).

In the present series, except in one instance (Case 1), I have operated only when obstruction persisted in spite of active peristalsis, as shown by well-marked cramp-like pain, gurgling on auscultation or visible peristalsis. Such obstruction has occurred in under 2 per cent. of my own appendectomies requiring drainage and in none of the undrained. Since, as we have seen, the probable cause of obstruction is fixation by recent adhesions there is a natural tendency to persist for a while in palliative measures, in the hope that the obstruction will be overcome. The decision as to which cases will free themselves spontaneously, as well as when the proper time has come to interfere, is a difficult one. I feel very strongly that the conservative thing is to operate early. It is not claimed that the cases here presented would necessarily have died of obstruction if not operated on. It is far better to operate occasionally unnecessarily than to postpone operation until the later stages of obstruction have developed.

If operation is undertaken we have naturally greater latitude after clean appendectomies. In suppurative cases a fresh incision under local anesthesia internal to the original one is advisable. If bloody serum is found on opening the peritoneum a search for a strangulated loop of bowel is naturally suggested.

If not we now have two possible courses: (1) to find and free the point of obstruction, or (2) to provide drainage from the bowel, either externally or by a short-circuiting operation. If we look for the obstruction and separate the adhesions forming it, raw fibrinous areas are left on the bowel which immediately readhere elsewhere, the bowel distention persists, septic material may be spread from the drainage tract, the bowel wall, possibly being extremely friable from distention and edema, may tear, and, lastly, the operation may be severe for a reduced patient. Obstruction may persist or recur, and we may only have exchanged one obstruction for another, particularly if a segment of the bowel is partially paralyzed from sepsis. The obstruction may be short-circuited by ileocolostomy without disturbing adhesions. But this also means a considerable operation. Drainage of the bowel may be provided more directly and with far less disturbance to the patient by ileostomy under local anesthesia. It has the obvious disadvantages of fecal discharge, fluid-loss, frequent skin irritation and possibly secondary operation for closure. The whole question is how often, when done for obstruction by plastic adhesions, will an ileostomy first relieve the patient, then close spontaneously and so serve not as a palliative but as a curative procedure.

Of the seven cases in one a cecostomy was done on the third day under local anesthesia in a man, aged forty-five years, with paralytic distention following appendectomy for gangrenous appendicitis with general peritonitis. Death followed in twelve hours. In a second, a child, aged ten years, recovery followed reduction of an ileo-ileal intussusception occurring on the fourth day after a clean appendectomy. In the remaining five cases ileostomy was done. Four were children of eight and nine years and one a man, aged twenty-one years. Obstruction occurred on the sixth and tenth day. One child had a previous enterostomy through the original incision on the eighth day by another surgeon, with temporary relief. A second ileostomy was done on the tenth day. The technic was similar in all cases, viz., an incision through the inner border of the right rectus or median line, choice of a distended bowel

loop which appeared lowest and therefore nearest to the point of obstruction. In two cases visible peristalsis gave a clue to the proper point of incision. In 4 cases the peritoneal cavity was free from adhesions except in the neighborhood of the original incision. Enterostomy was done in all cases with a flanged glass tube and a purse-string suture, with no attempt to make a valvular opening to aid closure. I should, of course, in the future use the technic suggested by J. W. Long[1] or by C. H. Mayo[2] to favor closure by means of inversion of the bowel wall around a catheter, and by bringing the catheter, if possible, through the omentum interposed between the bowel and abdominal wall.

The after-course in all cases was similar; with the relief of the distention the bowel moved spontaneously on the third to the fifth day. This strongly suggests in the type of cases operated on that an obstruction by angulation of the ileum, as described by Cheever,[3] existed. Fixation of the bowel probably occurred, with angulation above it, and thus made a valvular obstruction, which became all the tighter the greater the distention and the more active the peristalsis. With distention relieved the bowel contents carried by the lateral enterostomy opening by bearing upon the point of obstruction, tended, aided by the subsidence of the inflammatory process and absorption of plastic exudate and edema, to stretch and free the adhesions forming it. It also suggests the chief measure to be taken to prevent the development of obstruction (in addition to the obvious ones of early operation, avoidance of trauma and care in placing drainage), in the avoidance of active catharsis during convalescence. This becomes imperative if symptoms suggest partial obstruction. If the bowel contents are driven against a point of adhesion, overdistention and valvular obstruction are all the more likely to occur. Should obstruction develop it also suggests that measures tending to relax the bowel, rather than stimulate it and increase local overdistention, are more likely to result in relief of the obstruction. It is in this way through relaxation of the bowel that the occasional relief of obstruction by spinal anesthesia probably occurs.

The after-history of the five cases has been similar. The enterostomies all closed spontaneously in from four to seven weeks, although some of them seemed extremely unfavorable in the beginning. Their behavior would make me extremely slow to close a lateral enterostomy by secondary operation, provided satisfactory movements were taking place by rectum. One case reports well, by letter, after eight years, two after about three years and one after one year. One case after two years is well except for a recurrent sinus in the original appendectomy wound. The ileostomy has remained healed. Relief of the obstruction in these cases has apparently been permanent.

No general conclusion can be drawn from so few cases, particularly since so large a proportion occurred in children, in whom the prognosis as to life and closure of the fistula may be more favorable than in adults. My own cases merely suggest that in the consideration of the treatment of obstruction a distinction should be made between obstruction occurring shortly after operation and obstruction occurring from spontaneous causes or long enough after operation for adhesions to cicatrize. The place of enterostomy is distinctly different in these two classes of cases. In the first class its place as an evil occasionally necessary is clear. In the second class, obstruction by recent adhesions, it may be both palliative and curative. Good results depend on operation being undertaken early, and it is far better to operate on an occasional case unnecessarily than to postpone operation until the later stages of obstruction have developed.

Case 1.—Cecostomy; death. A man, aged forty-five years. Operation at Henry Heywood Hospital, Gardner, Mass., May 9, 1910, on the fourth day of the disease. Appendix, adherent to brim of pelvis, perforated at tip. Abdomen contained a large amount of thin, gray, foul-smelling fluid. Drainage by three cigarette wicks. Peristent vomiting, distention, obstipation following operation. May 12, cocain anesthesia; cecostomy. Death in twelve hours.

Case 2.—Reduction of intussusception; recovery. J. R., male, aged ten years, patient of Dr. Joslin, Milford, Mass. Operation April 8, 1913, by another surgeon. Appendectomy without drainage for catarrhal appendicitis. Convalescence at first satisfactory. Bowels moved well on third day. April 12, abdominal pain and distention began with vomiting. April 15, obstruction complete for two days, vomiting feculent for twenty-four hours. No blood from rectum. Operation: ether; median incision; peritoneal cavity clean and free from adhesions; beneath first incision an ileo-ileal intussusception five inches long. Intussusception reduced. Good recovery.

Case 3.—Ileostomy; recovery. L. F., female, aged eight years, patient of Dr. H. C. Williams. Appendectomy with drainage October 23, 1911, by Dr. M. H. Richardson, on the third day of the disease for retrocecal appendix lying in a small abscess cavity. Drainage. Convalescence at first satisfactory. On the seventh night colicky abdominal pain, increasing through the eighth day, with vomiting. No results from enemata. On the ninth day distention with visible peristalsis. Operation by Dr. E. P. Richardson; ether; median incision, ileostomy without exploring or separating adhesions. On the fifth day movements began by rectum. Discharged on forty-eighth day, with fistula closed. Patient reports herself entirely well November 24, 1919.

Case 4.—Ileostomy; recovery. Massachusetts General Hospital. Record No. 186876. A man, aged twenty-one years, sick three days with abdominal pain. Admitted with a temperature of 103°; pulse 112. Immediate operation January 3, 1913. Appendix found hanging over brim of pelvis, gangrenous in distal half and perforated. Abdomen contained thin pus, not walled off. Appendix removed. Cigarette drain to pelvis and appendix stump. Temperature normal on second day. Convalescence apparently satisfactory. On the tenth day colicky abdominal pain; on the eleventh day pain more severe; abdomen beginning to distend; enemata ineffectual; vomiting. On the twelfth day condition similar; pain more severe in the evening; vomiting feculent. On the thirteenth

day general condition serious; abdomen distended, its superficial circulation sluggish; distended intestinal coils visible. Operation: ether; incision through right rectus muscle to inner side of original incision. Peritoneal cavity clean. Glass tube tied in presenting distended bowel. Following operation free discharge through the tube. Bowels moved by rectum on fourth day. Gradual closure of fistula. Discharged on forty-eighth day. Writes January 23, 1914, "Wound healed completely three weeks after going home. General health excellent. No disabilities."

CASE 5.—Ileostomy; recovery. N. L., male, aged nine years; patient of Dr. Duggan, Milford, Mass. Operation May 5, 1916, at Milford Hospital; removal of gangrenous appendix lying in a localized abscess to the outer side of the cecum close to the abdominal wall. Drainage; convalescence unsatisfactory from the beginning, with tendency to distention, occasional vomiting and abdominal pain. Enemata at first gave partial relief, but distention gradually increased; the vomiting became more persistent and feculent in character. On the eighth day enterostomy through the original incision by another surgeon. This resulted in a moderate amount of fecal discharge and slight improvement in general condition for a few hours. The distention and vomiting persisted, however, and the child's condition became desperate. On the tenth day ileostomy through an incision at the inner border of the right rectus muscle. The abdomen was free from adhesions except in the region of the original wound. Glass tube tied in distended loop of bowel running toward these adhesions. The vomiting and distention were relieved. Three days following operation there was a free movement by rectum. Movements by rectum continued; the discharge through the two enterostomies, at first large in amount, gradually diminished, and he was discharged on the forty-first day following the original operation, the enterostomies practically closed. His father writes, December 7, 1919, that the boy is well except for nervousness; the wound has remained healed and he has no pain.

CASE 6.—Ileostomy; recovery. V. M., girl, aged eight years;

patient of Dr. Joslin, Milford, Mass. Appendectomy with drainage for acute appendicitis by another surgeon February 1, 1917. Temperature, 101°, dropping to normal on the third day. Convalescence was satisfactory until evening of the fifth day, when severe cramp-like abdominal pain developed with repeated vomiting. Obstruction was complete for 24 hours, after which bowels moved freely. On the tenth day recurrent abdominal pain, with repeated vomiting. I saw her on the morning of the eleventh day, when obstruction had been complete for 24 hours. Her abdomen was distended with prominent coils of small intestine, visible in active peristalsis. Although it was obvious that this obstruction might relieve itself as the previous one had, it seemed safer under the circumstances to provide drainage. Operation February 12: ether; incision through inner border of right rectus muscle. Abdomen free from adhesions except in the region of the old wound. Ileostomy by means of glass tube in loop of ileum as near as possible to apparent point of obstruction. Good recovery. Bowels moved freely three days later and regularly thereafter. Gradual lessening of fecal discharge on twenty-fifth day. November 22, 1919, her father writes that she is well, the wound has remained healed and that she has had no pain or discomfort from the operation.

Case 7.—Ileostomy; recovery. Massachusetts General Hospital. Record No. 216397; boy, aged nine years. Operation July 27, 1917: ether; appendectomy with drainage for acute appendicitis and diffuse peritonitis. A large quantity of thick, free pus in abdominal cavity. Appendix gangrenous and perforated. Following operation vomiting ceased and gas was occasionally passed, but moderate distention persisted and his condition was never satisfactory. On the fourth day distention increased, partially relieved by enemata. On the sixth day vomiting developed, with marked abdominal pain. On the next day vomiting and pain continued. Enemata were without effect; distention was increased. Operation; median incision with novocain anesthesia. Glass tube tied in dilated ileum with purse-string. Intestinal coils adherent, with soft adhe-

sions. The following day vomiting ceased and distention was less. Five days after ileostomy there was a voluntary movement by the rectum. The discharge from the ileostomy greatly decreased ten days after it was made and had almost ceased two days later. The boy was discharged on the thirtieth day; wound partially healed. His mother reports by letter, November 23, 1919, that the boy's general health is very good and that he has no discomfort except from a recurring sinus in his original appendix incision. The ileostomy has remained healed.

References

1. Long, J. W.: Tr. Southern Surg. Assn., 1916, xxix, 59.
2. Mayo, C. H.: Annals of Surgery, 1917, lxvi, 568.
3. Cheever, David: Boston Med. and Surg. Jour., 1914, clxviii, 719

INTUSSUSCEPTION RESULTING FROM BENIGN TUMOR OF THE INTESTINE: REPORT OF THREE CASES

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From the standpoint of the surgeon it is usually held that benign tumors of the small intestine are comparatively unimportant. The basis for this view exists in the infrequency of the occurrence of such neoplasms and also in their non-malignant nature. How seldom benign tumors are encountered anywhere in the gastro-intestinal tract seems illustrated by the paper of King,[11] appearing in 1917, in which it is stated that a careful search of the literature enabled the author to find the reports of only 118 cases of benign intestinal tumors in which the diagnosis had been confirmed histologically. Among the reports collected by King were those of 17 adenomata, and of this number only 5 were located in the small intestine. It has been pointed out by Rhodenburg[15] that King was too conservative in the selection of cases for his summary, omitting reported instances of lipomata, myomata and fibromata which had been confirmed histologically. The same criticism seems to be valid in regard to his selection of adenomata, as will be shown later. But although wanting in strict accuracy, King's paper serves to show that the occurrence of such tumors is uncommon in the experience of surgeons.

Kasemeyer[9] has emphasized that these so-called benign tumors not infrequently may give rise to serious or even fatal disturbances. A profound degree of anemia may result from

the constant hemorrhage following trauma to the new growth, but of particular interest in this connection is the possibility of intussusception resulting from their presence.

During the past ten years, in my private work, it has been my fortune to encounter one case of fibroma and two cases of adenoma of the small intestine. These cases are interesting not only because of their comparative rarity, but also because in all three patients a condition requiring prompt surgical intervention existed, namely, an intussusception. The reports of cases are as follows:

Case I.—M. W., female, aged eight years, admitted to Johnston-Willis Sanatorium on September 9, 1919. Family history: Negative. Past history: Has never been healthy, but weak and undernourished. For past two years has suffered with severe abdominal pain, regurgitation of food and constipation at times. Present illness: Seventy-two hours before admission to the hospital she suffered with an attack of severe abdominal pain accompanied by nausea, vomiting and constipation. On admission she appeared sick and toxic and had persistent vomiting. Physical examination: A weak, emaciated child, apparently undernourished. Tenderness over abdomen; a mass could be palpated in abdomen, approximately in midline, just below umbilicus, about size of a lemon. A diagnosis of intussusception was made. Operation advised.

The abdomen was opened through a right rectus incision, an intussusception of the ileum delivered, impossible of reduction. A resection of eighteen inches of the small bowel up to within six inches of ileocecal valve, gangrenous bowel removed *en masse,* end-to-end anastomosis. Opening of specimen revealed a tumor at the apex of the intussusceptum. Death fourteen hours later. No autopsy.

Pathological Report: The tumor was globular in shape and measured about 2 cm. in diameter. It was hard and smooth and embedded in the serous coat. Microscopic examination showed the tumor to be made up of a dense fibrous tissue. Diagnosis: Fibroma.

Case II.—W. B., male, aged sixteen years, admitted to Johnston-Willis Sanatorium on June 29, 1910. Family history: Negative. Past history: Always healthy, except that he has, for several years, been subject to attacks of abdominal pain. A year before coming under our care a diagnosis of appendicitis was made and the appendix removed, without, however, affording relief from the abdominal pain. Present illness: A week before admission he suffered from an attack of abdominal pain of unusual severity, accompanied by nausea and vomiting. On admission he complained only of general abdominal tenderness. Physical examination: A strong, well-nourished boy, apparently in perfect physical condition. A three-inch scar over McBurney's point; slight abdominal distention and general tenderness on palpation.

It was deemed advisable to employ expectant treatment and keep the patient under observation, in the hope that another attack of pain might occur and a clue obtained as to the cause. Ten days after admission he was seized with severe abdominal cramps. Examination revealed a mass lying across the abdomen. A diagnosis of obstruction was made. Operation advised.

The abdomen was opened through a right rectus incision. As soon as the peritoneum was incised a very much thickened and enlarged small bowel came into view. The mass, which had been palpated previous to operation, was delivered outside the wound and found to consist of an invagination of the ileum, at least three feet in length. The intussusception was easily reduced, revealing the presence of a tumor about the size of a pigeon's egg and occupying the apex of the intussusceptum. Below the tumor the lumen of the intestine was greatly enlarged, the walls being much thickened and hypertrophied, giving an appearance such as is often seen in the intestine above a partial chronic obstruction. Since, however, in this case the hypertrophied gut lay below the tumor, its occurrence could only be explained by the repeated formation and reduction of an intussusception. The wall of the intestine was incised at the site of the tumor and an elliptical portion of the

wall, bearing the attachment of the tumor, was excised. Microscopic diagnosis: Adenoma.

Case III.—A. K., female, aged seven years, admitted to Johnston-Willis Sanatorium on April 6, 1919. Family history: Negative. Past history: One year prior to admission the patient had an attack of abdominal pain of great severity, but recovered without being seen by any physician. Three weeks ago a similar attack occurred, lasting several hours. Again, no physician was called. Present illness: Three hours before admission, while playing in the park, the patient was seized with agonizing abdominal pain, accompanied by nausea and vomiting. The pain was so severe that the child was completely prostrated. Physical examination: A mass, several inches in diameter and about a foot in length, extended diagonally across the abdomen, just above the umbilicus. A diagnosis of intussusception was made.

Two hours after admission, her condition being unaltered, an operation was advised. Through a midline incision the mass was delivered and found to consist of an ileal intussusception, about two feet in length. The invagination was reduced with great difficulty, and, as in the preceding cases, a small, pedunculated tumor was found at its apex. The serosa over the attachment of the tumor presented a puckered appearance, resembling that sometimes seen in the skin over early carcinoma of the breast. For this reason it was deemed wise to resect about six inches of the small intestine, followed by end-to-end anastomosis. Child reported fully recovered eight months after operation.

Pathological Report: The tumor measured 2 cm. in length, 1 cm. in thickness and 1 cm. in depth. It was soft, smooth and pinkish gray in color, and it was attached to a small portion of the bowel wall by a pedicle which measured ½ cm. in length and ½ cm. in thickness. On section it appeared to be lobulated, and the lobules varied in size from a pin-point to a pin-head. Microscopic section (transverse) showed the tumor to have a gland-like structure, not unlike that seen in a normal

mucosa. The acini were lined by a columnar epithelium and goblet cells. Some of the acini were cystic and contained mucus. There was a connective-tissue stroma between the gland-like collections of epithelium. Near the pedicle and in the region of its attachment to the bowel wall the acini suggested a malignant degeneration, but there was no apparent invasion of the bowel wall. Diagnosis: Adenoma.

All of my cases were in children from seven to sixteen years of age. Symptoms of recurring attacks of abdominal pain extending over a period of one to five years occurred in all. The tumor was in the ileum in every instance. It was necessary to resect the bowel in two cases of acute intussusception. In one case, a chronic reducible type, plication of the bowel was all that was necessary. Two recovered and one died. Microscopic examination showed one to be a fibroma and two to be adenomata.

Summaries of the reported cases of fibromata of the intestine have been made by King[11] and also by James and Sappington[8], the latter authors being able in 1917 to collect from the literature the reports of twenty-five cases of intestinal fibroma. Rhodenburg[15], in April of this year, reported two more cases and another has been reported by Henrichsen[7]. I have been particularly interested, however, in the adenomata and shall confine myself chiefly to a discussion of this type of tumor.

As has already been mentioned, King, in 1917, was able to find recorded in the literature the reports of only five adenomata of the small intestine, and in only two of these cases was the tumor accompanied by intussusception. On the other hand, Kasemeyer, five years before the appearance of King's paper, collected the reports of ten cases of adenoma of the small intestine complicated by intestinal invagination.

In addition I have been able to find the following cases of adenoma associated with intussusception reported, which, though the diagnosis was confirmed by microscopic examination, were omitted from Kasemeyer's and from King's summaries:

Scudder[16]: Young male adult. Adenoma of ileum accompanied by intussusception and volvulus. Operated. Recovered.

Watts[18]: Male. Twenty-four years. Multiple adenomata; recurring intussusception. Operated. Recovered.

Brataud[1]: Female. Sixteen years. Multiple adenomata; recurring intussusception. Operated. Recovered.

One paper, containing report of two cases by Hartmann[6].

Since the appearance of King's paper, reports of the following cases of adenoma of the small intestine associated with intussusception have been published.

Keilty[10]: Male. Twenty-three years. Adenoma of jejunum with intussusception. Succumbed.

Ludlow[13]: Young male adult. Adenoma of jejunum with intussusception. Operated. Recovered.

So far as I have been able to ascertain, only seventeen authenticated cases of adenoma of the small intestine associated with intussusception have been reported. The addition of my two cases brings the total number to nineteen.

The manner in which the intussusception is produced has never been satisfactorily explained. The view which seems most natural to accept is that the body of the tumor, lying within the lumen of the intestine, offers an object which the wave-like contractions of the circular muscle can grasp and force onward, exactly as they do with a bolus of food. As a result of this forcing onward of the tumor, traction is exerted on its point of attachment, tending to pull inward and downward this part of the intestinal wall, thus starting an intussusception, which is increased by the subsequent waves of peristalsis. This method of formation seems to have been demonstrated in the cases reported by Fuchsig[4], Smoler[17], Brataud[1] and Watts[18], where milking the tumor downward caused a depression in the wall of the gut at the point of the tumor's attachment, and, later, a beginning invagination.

Against this theory two objections have been raised. First, in a certain number of cases in which tumors have given rise to intussusception, the tumor has not occupied the apex of the

invagination. This, it seems to me, does not disprove the theory. If we accept the view that the intussusception is sometimes formed and may then undergo spontaneous reduction it is at least possible that those cases in which moderately large tumors are not at the apex of the intussusception represent instances in which the process of reduction is taking place, the waves of reversed peristalsis having seized the tumor and carried it backward.

On the other hand those cases in which many small tumors are accompanied by intussusception cannot be explained by this "mechanical" theory. Here we are forced to accept the explanation of some abnormal "stimulus" to the intestinal wall. Attempts have been made to explain the mode of action of this "stimulus," but one is forced to conclude that none of the explanations is satisfactory. Nothnagel and Morris believe that a spastic contraction of a portion of the gut occurs and this contracted part forms a fixed point, the intestine immediately below being drawn up over it, forming the intussuscipiens, while the contracted part is the intussusceptum. Peyer and Leichtenstern[12] hold, on the contrary, that the essential condition leading to intussusception is a localized paralysis of the intestine; the paralyzed part, according to Peyer, forming the intussuscipiens; according to Leichtenstern, the intussusceptum.

The records of certain surgical clinics also seem to indicate that adenoma of the small intestine necessitating surgical intervention is rarely encountered. Thus, King states that no such case occurred among 44,654 abdominal operations at the Mayo Clinic, nor did any appear in the records of the abdominal operations at the Charity Hospital of New Orleans "for many years back," although about 10,000 operations were performed annually at this institution. In approximately 25,000 operations at the Boston City Hospital adenoma of the small intestine was encountered only once and was not associated with intussusception.

In spite of this evidence I am inclined to suspect that adenomata as well as other benign tumors of the small intestine

are not so extremely uncommon. When one reviews the histories of practically all of the reported cases, two striking features are to be observed: (1) The patients were seriously ill when they came under the care of the surgeon, and (2) there is good reason to believe that similar but less severe disturbances had taken place in the past, but spontaneous relief had occurred. This latter point is well illustrated by the three cases I have reported. In all of them the history strongly suggested the previous occurrence of intussusception, and the appearance of the intestine at operation in Case II proved that such an occurrence had taken place.

It has been demonstrated that pedunculated tumors may be torn from their attachment[9], and I believe that this may not be very uncommon. It seems not unlikely that the constant pressure and tension may cause the new growth to atrophy in some cases; while in still others they may never attain sufficient size to cause any disturbance. Finally, we must remember the possibility of benign tumors undergoing malignant degeneration and admit that a certain proportion of intestinal carcinomata and sarcomata may have originally existed as adenomata or myomata.

It does not seem unreasonable, therefore, to assume that the patients who are critically ill, whose condition is such as to demand immediate surgical intervention, constitute only a small proportion of the cases of benign intestinal tumor and the possibility arises that a certain number of individuals who suffer from recurring attacks of abdominal pain may owe these symptoms to the presence of a benign tumor of the intestine. This view is strongly supported by the autopsy records from the Boston City Hospital, which were recently communicated to me through the courtesy of Dr. F. B. Mallory. In a total of 4165 autopsies, adenomata of the small intestine were encountered four times, giving an incidence of almost one case of every thousand that came to autopsy. Benign tumors of all kinds were encountered in eleven instances.

In addition, through the kindness of Dr. Wright and Dr. Richardson of the department of pathology of the Massachu-

setts General Hospital, Mr. A. M. Bagusin investigated the records of 3327 autopsies performed at that institution. A total of eight benign tumors of the small intestine was encountered in this series, but only one adenoma.

The fact that my own cases were operated on at a time when obstruction due to intussusception had produced a serious abdominal emergency, indicates that tumors of the small intestine may be an etiological factor in the intussusception of young children. There are several reasons for overlooking a tumor of the small intestine when operation is done for the resulting intussusception. If the invaginated gut is reducible, and resection not advisable, a small tumor projecting into the lumen may easily escape detection, owing to the edema and infiltration of the intestinal wall.

It is also reasonable to assume that a pedunculated tumor occupying the tip of the invaginated gut, and therefore the zone of great ischemia, would be destroyed by gangrene in many cases, while the gut with its nutrition less impaired might regain its normal vitality after reduction of the intussusception and the application of moist heat. Operations for intussusception in young children are often grave emergencies, and the surgeon is chiefly concerned in making a decision between simple reduction and excision of the invaginated gut. It is reasonable to assume that many specimens of intestine removed at operation for intussusception, if carefully studied, will show the remains of a tumor, spontaneously destroyed by interference with its vascular supply. This hypothesis is not submitted as an explanation of all cases of intussusception in children. More and better study is necessary to determine the relationship between tumor and invagination.

In conclusion the following points seem to deserve special emphasis:

(*a*) The possibility, or, indeed, the probability, exists that benign tumors of the small intestine are of more frequent occurrence than the number of cases reported from surgical clinics would lead one to suspect.

(*b*) There is no reason to believe that the material from the

Boston institutions is unique and that Bostonians suffer from benign intestinal tumor more than persons in other localities. Accepting this, we face the striking fact that approximately one person in every 1500 coming to autopsy shows the presence of adenoma of the small intestine. Even more striking is the fact that in the 7492 autopsies, benign tumors of the small intestine were encountered nineteen times, so that we have an incidence of nearly one to every 400 autopsies.

(*c*) In considering the few cases of adenoma that have been reported by surgeons it must be remembered that many of the so-called "polyps" are adenomatous in structure, but cannot be included because of the failure to make a histological examination of the tumor.

Bibliography

1. Brataud: Surg., Gynec. and Obst., 1914, xix, 30.
2. Eiselberg: Arch. f. Clin. Chir., 1903, lxix, 1.
3. Fleinder: Virchows Arch., 1885, ci, 484.
4. Fuchsig: Wien. kiln. Wchnschr., 1901, No. 8, p. 182.
5. Gessler: Centralbl. f. Chir., 1895, No. 8, p. 204.
6. Hartmann: Presse méd., xxi, No. 22.
7. Henrichsen:
8. James and Sappington: Annals of Surgery, 1917, lxv, 109.
9. Kasemeyer: Deutsch. Ztschr. f. Chir., 1912, cxviii, 205.
10. Keilty: Jour. Am. Med. Assn., February 23, 1918.
11. King: Surg., Gynec. and Obst., 1917, xxv, 54.
12. Leichtenstern: Prager Verteljahrschr. f. prakt. Heilkunde, 1873, ii, iv.
13. Ludlow: China Med. Jour., xxxii, 425.
14. Mayo: Annals of Surgery, 1896, xxiv, 733.
15. Rhodenburg: Jour. Lab. and Clin. Med., No. 7, iv, 434.
16. Scudder: Annals of Surgery, 1910, li, 237.
17. Smoler: Beitr. z. klin. Chir., 1902, xxxvi, 139.
18. Watts: Annals of Surgery, 1911, liii, 408.

PERFORATIONS OF THE GASTRO-INTESTINAL TRACT

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With a perforation of the gastro-intestinal tract the doctor or the surgeon finds himself face to face with one of the most desperate surgical conditions with which he could be confronted. Any delay whatever from a mistaken diagnosis or hesitancy as to what he is to do means almost certain loss of the patient, for a good percentage of these cases will be lost under the most favorable conditions. Fortunately, in the majority of cases, they speak to us in unmistakable signs and symptoms, and our greatest trouble is in not interpreting them according to these almost pathognomonic signs. All of us can make the diagnosis; we do make it in the largest majority of cases, but we have not the courage to back up our judgment. So we, casting about for an excuse, seize upon some insignificant symptom, that, by exaggerating greatly, might simulate some other condition, overlooking all the time the "box-car letters" that the clinical history and physical signs hold up to us in such bold relief, that we should read as we run.

In every acute abdominal pain the possibility of a perforation of some part of the alimentary canal should be considered, and the case should not be dismissed, if at all obscure, until perforation has been definitely excluded. Nearly all of these cases are classical and present almost the same phase no matter what part of the tract is the seat of the perforation or what the pathological conditions that produce it.

Every man in the practice of medicine should have clearly in his mind the differential points in the diagnosis of this condition as well as a clear-cut, fixed idea as to its treatment. Prompt diagnosis and prompt treatment are necessary if the patient is to be saved.

The dictum so often applied to a strangulated hernia can with equal force be applied here: "Never let the sun rise or set" on this condition without an attempt at relief. Perforation from gastric and duodenal ulcers, perforation of the gall-bladder, the appendix and typhoid perforations are all of the same type and are those to be considered at this time. In our preliminary examination of the patient we invariably elicit a history that in a general way sets forth a pathological condition that might result in the perforation of the viscus. Thus we get the history of the gastric or duodenal ulcer, gall-bladder infection, typhoid fever or appendicitis. A history of any one of these pathological conditions should at once put us on our guard and prepare us to interpret correctly these classic symptoms that are present in nearly all if not in every case.

The symptoms given by Mayo Robson are as follows: "A sudden, sharp, abdominal pain. Almost immediately the expression of the face changes to one of anxiety and great distress; the extremities become cold and clammy and the face blanched; the respirations are usually shallow and quick and the pulse rapid and almost imperceptible at the wrist; vomiting may occur. As a rule the patient rallies and the initial symptoms of the shock pass off to a certain extent. There is then a great complaint of thirst which cannot be satisfied, and the urine is scant and high-colored."

I only call your attention to and wish to emphasize the cardinal symptoms, namely, sudden, sharp, abdominal pain, vomiting, board-like rigidity of the abdominal muscles attended with shock. These cardinal symptoms are present in all cases of perforation, but some of them differ in degree of intensity, depending upon the location of the perforation. For instance, a perforating gastric or duodenal ulcer or a typhoid ulcer is attended by more pain and rigidity than a perforation

of the gall-bladder or appendix. The sudden emptying of the contents of a distended gall-bladder into the unprepared peritoneal cavity sometimes brings about intense shock that may prove immediately fatal. Usually, however, the inflammatory trouble has already produced pericystic adhesions, so that the general peritoneal cavity is protected against this flood of septic material; but the pain and the shock usually predominate here.

These cardinal symptoms are perhaps less marked in perforation of the appendix vermiformis than in the other conditions, and I am sure that these perforations occur more frequently than is generally supposed. Here the general peritoneal cavity is protected by adhesions, the omentum serving a most useful purpose, surrounding and becoming adherent to the inflamed organ before the perforation occurs, resulting in a localized abscess. This walling off of the viscus by the omentum and the rapidly formed peritoneal adhesions account in a measure for the modified intensity of all the cardinal symptoms. Herein lies the great danger from appendicitis. It is comparatively free from danger until perforation does occur. All of us can diagnose a case of appendicitis with comparative ease and certainty; in fact, the laity is educated up to the point where they can make the diagnosis themselves. But who among us can foretell what course it will pursue after the diagnosis is made—whether it will be followed by perforation, peritonitis and death when left alone or drain itself back into the lumen of the gut with partial or complete recovery? Here the correct interpretation of the cardinal symptoms will usually lead us aright. If they do not a few hours after the initial symptoms of an attack of appendicitis an increasing shock, manifested by an increasing rapidity of the pulse, even though all the other cardinal symptoms of appendicitis have subsided, is enough to predicate the diagnosis of a perforation of the viscus. We may and will have falling of the temperature, relief from the pain, less rigidity and vomiting, but the pulse-rate climbs up apace; this is the one symptom that should always be heeded and taken at its full face value as acquainting

us with what is occurring in the appendix. It means perforation, present or pending, in almost all if not in every case.

As every case of typhoid fever is liable at any moment, especially during the latter part of the second and during the third week, to become a very urgent emergency surgical case by the occurrence of a perforation, everyone treating a case of typhoid fever should be on the alert to recognize this condition, that prompt surgical aid can be rendered. It is doubtful if we have even yet fully realized the importance of perforation as a mortality factor in typhoid fever, or the number of lives that we might save by a prompt diagnosis of this calamity and a timely operation.

When we come to discuss the treatment of perforations of the gastro-intestinal tract we must take into consideration the pathological process that causes the mortality. Here septic intoxication is the primary and most frequent cause of death in all cases of perforation peritonitis. The prevention of absorption, therefore, is of the greatest importance. There is, however, a preoperative period in which much may be done to retard absorption while preparing for surgical intervention.

The preoperative and postoperative importance of the Fowler position, I think, is yet greatly underestimated by not a few surgeons. The patient should be placed in the Fowler position at his home the moment that the diagnosis is made and kept so until convalescence is well advanced. He should be taken to the hospital in this position to prevent the spreading of the infection to the upper abdomen during the transportation, carried to the operating room and operated upon with the shoulders, at least, well elevated. This procedure is based on the physiology of peritoneal absorption, both normal and pathological, as so understood and accepted by all, and further discussion is not necessary before this body.

It is scarcely necessary to dwell on the importance of peristaltic rest by withholding food (emphasized by Ochsner) or the application of cold to the abdomen for lessening the distribution of the infected material. The use of opiates as a preoperative measure after the diagnosis is made is to be com-

mended. The relief from pain and the mild cardiac stimulation produce a sense of well-being in the patient, and, according to Crile, this constitutes one of the best measures to combat shock by protecting the nerve centers from damaging influence of the toxins. There is no good reason why opiates should not be used, and used unsparingly, until the full therapeutic effect is obtained.

Another preoperative measure in the intensely toxic patients: an intravenous injection of two or three pints of normal salt solution or a simple hypodermoclysis under the breast materially improves the condition.

As to the anesthetic to be used, of course, the ideal would be local anesthesia, but very few of us are expert enough in the use of a local anesthetic to obtain the very best results, and an imperfect local anesthetic will give more shock and prostration than a general anesthetic. Ether is only slightly objectionable, owing to its deleterious effect upon the kidneys, and I think this danger is overestimated. If the narcosis is not carried too far and is continued for only a short time very little harmful effects will be noted and a much more satisfactory operation can be done.

The line of incision is preferably made over the seat of the perforation when its location has been determined, otherwise it is made at the right of the median line, as perforations are much more common in the right than in the left half of the abdomen, and the incision can be enlarged upward or downward *ad libitum* without dividing muscle fibers transversely.

In all of our procedures the time element of the operation itself is of the utmost importance. Quickly in and quickly out should be the object, as labored and prolonged technic will kill more than it will save. The operation should be done with the greatest promptness possible, compatible with good and thorough work, regardless of the shock present at the time. Death is not as likely from shock as from peritonitis if operation waits on shock. Our only aim in operating is to stop the leak and establish free drainage before overwhelming toxemia and peritonitis take place.

Closure of the leak is of the utmost importance. If the leak is in the appendix, for the sake of speed clamp it at the base, ligate it in the crease made by the clamp and amputate; burial of the stump in this friable indurated condition of the gut usually entails too much time and manipulation to warrant its execution. If the leak be in the intestines or from a gastric ulcer it should be closed, if possible, with a double or triple row of Lembert sutures, preferably of fine silk, by simply infolding the edges of the opening in any direction that interferes less with the lumen of the bowel. Duodenal perforations are usually easy to close, but in gastric cases, with considerable inflammatory induration about the ulcer, or in large typhoid ulcers, this may be difficult or impossible. In some cases we can best close the opening by stitching a coil of the small bowel or colon over it and then cover with omentum if possible. Murphy emphasized this point, never to permit the opening of a perforation to remain patent, depending upon our drainage for relief, and for us not to resect a gastric ulcer in the presence of a perforation. If the pylorus is involved in the induration, and obstruction is likely to follow, perform a posterior gastrojejunostomy with as much speed as possible.

A recent author reported nineteen cases of perforation of the duodenum, all of them drained without closing the perforation. Eighteen of the patients died shortly after the operation and the nineteenth died six months later from a secondary abscess. The mortality from simple drainage without closure of duodenal, gastric and intestinal perforations is such as to brand this line of treatment as inefficient and unjustifiable. An exception to this rule might be made in some cases of perforation of the gall-bladder. The ideal method here would be a cholecystectomy, but, unfortunately, this takes time, extensive manipulation of the neighboring viscera and the opening of the large amount of raw surface, all of which would add to the already dangerous condition. The tissues around the opening in the gall-bladder are friable and necrotic, with a very much thickened and indurated wall. Here it is best to set a tube into the bladder cavity and close the opening around it with a

purse-string suture to limit the amount of the purulent material entering the abdominal cavity. Fortunately perforations of the gall-bladder are rare.

We see clearly that the first essential after you open the belly is to find the hole and close it. The next essential after closing or dealing with the perforation is to put a drainage in the most dependent portion of the abdomen, so far as that particular perforation is concerned. Do not roughly sponge or wash out the abdomen but put in a tube to relieve the tension of the products of infection, just as if you were dealing with a phlegmon of the thigh. Washing removes the pus, with its myriads of leucocytes sent there for the sole purpose of protection. If it be soon after the peritonitis has set in the pus may contain only the harmless Staphylococcus albus; if it be late, washing will endanger the patient, in that it tends to carry virulent colon bacilli to new unaffected parts of the peritoneum. Irrigation of the whole cavity prolongs the operation, necessitates more or less evisceration, traumatizes the peritoneum, spreads the infection and many times carries the infection to the deadly diaphragmatic zone.

I think it is a surgical principle, accepted by all, that the relief of pus tension is the first surgical step toward retarding absorption in all acute infections. No tension no absorption; hence maintaining of low pressure in every pus pocket is indispensable to continued freedom from absorption, and this low tension can only be accomplished and maintained by efficient drainage. Fenestrated or split rubber tubes inserted to the stump of the appendix or the site of the ulcer and into the vesicorectal or Douglas' pouch and any other pus pocket that may exist is the only form of drainage that is permissible. Glass tubes cause strangulation, pressure necrosis and kinks that have been a frequent cause of death. Gauze-packing drains, loose or cigarette, cease to be drains in a few hours and are then a distinct menace. They are used only to wall off intestinal contents when necrosis has occurred or is imminent, and then only in conjunction with tubes. With this simple technic I have had nine consecutive cases of perforation to get

well; one duodenal, two gastric, three typhoid and three of the gall-bladder. Three of the series were desperate, and only the success with the others encouraged me to operate upon them at all.

The one or two important points I wish to accentuate are the following: In every case of perforation, no matter what the condition of the patient, there is an absolute indication for immediate operation. If the symptoms point rather definitely to perforation, but the diagnosis is in some doubt, exploration is safer than delay. Closing the opening is a *sine qua non* to success in any of our operative measures. Shock is no contra-indication to operation. The operation should be as expeditious as possible, only what is necessary being done, and artistic ideals should be left to less urgent cases.

SOME ABDOMINAL COMPLICATIONS OF INFLUENZA

By Alexius McGlannan, M.D.
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The association of abdominal symptoms with the onset of respiratory diseases and the development of abdominal lesions as complications of such diseases occur with frequency sufficiently great to rob them of all claim to novelty. The influenza epidemic gave an opportunity for extensive study of such occurrences and brought out several reports. I shall not attempt to discuss all the possibilities in this field, but shall comment on a few conditions observed during the epidemic.

Acute abdominal symptoms were present in a large proportion of the cases of influenza pneumonia. We did not note any definite relation between the area of pulmonary involvement and the abdominal symptoms. Acute appendicitis was the lesion most often mimicked, while the symptoms of cholecystitis and ruptured gastric and duodenal ulcer were also noted.

Hall and Dyas[1] suggest that the occurrence of symptoms of acute appendicitis in patients at the onset of influenza or pneumonia may be the result of bacterial invasion of the lymphoid areas of the appendix. As the abdominal symptoms were not persistent and their patients ran the average course of influenza the process must have been limited to this primary invasion of the appendix.

Jour. Am. Med. Assn., March 8, 1919, lxxii, 726.

What influence, if any, this sort of involvement of the lymphoid areas would have on the subsequent history of the appendix is not clear. If any appreciable reaction of the tissues took place it would seem to prepare the way for the later development of disease of the appendix. That such a sequel is possible seems proved by the experience of Hall and Dyas at Camp Logan. They noted a great increase in the number of cases of acute appendicitis coming to operation in the two months immediately after the epidemic. The average incidence of appendicitis in the camp was 10.4 per 1000, but during the time mentioned it arose to 44.4 per 1000.

During an epidemic when the thoracic lesions are so emphasized everyone remembers the false abdominal symptoms and mistakes in diagnosis are rare. Under ordinary circumstances one could easily confuse the symptoms of onset of acute appendicitis and those of pneumonia.

Asserson and Rathburn[1] call attention to the following valuable expedient: The area of maximum pain and tenderness is carefully mapped out. The patient is then directed to hold his breath. As long as the diaphragm is quiet the referred pain and tenderness remain absent. This point helped us exclude an accute appendicitis in the case of a student who was brought to the hospital with abdominal symptoms at the time of onset of his pneumonia on the second day of his attack of influenza.

Roentgen-ray examination of the chest may be an important aid in diagnosis. In one of our cases the plate indicated an area of consolidation, which could not be made out by physical examination of the chest. The symptoms were those of acute appendicitis, but because of the roentgen-ray finding these were considered false. The patient went through a typical pneumonia and recovered.

Reginald E. Smith[2] notes that the pain and rigidity in the upper zone are referred along the course of the 8th, 9th and 10th intercostal nerves. Less frequently the 11th and 12th

[1] U. S. N. Med. Bull., No. 1, p. 29.
[2] Lancet, March 15, 1919, i, 421.

nerves have caused the referred pain. On two occasions he blocked the 8th and 9th nerves and the symptoms disappeared. Smith divides the abdominal complications of influenza into three types of lesions: (I) Acute streptococcus peritonitis, which is hematogenous in its origin and often associated with streptococcus endocarditis. (II) Acute dilatation of the stomach, a toxic manifestation. (III) Coincident acute abdominal lesions. During the epidemic all complications were relatively small in number, because so many patients died in the first few days of the illness as a result of the intense infection.

A hematogenous peritonitis of varying extent is one of the commonest abdominal complications of influenza. When this peritonitis is a diffuse one it is a part of a severe generalized infection and does not give the usual picture of such a peritonitis. Beals, Blanton and Eisendrath,[1] in their report, note that in six such cases coming to autopsy the diagnosis had been made but once.

Subphrenic abscess and localized peritonitis in the region of the diaphragm could easily be confused with thoracic disease, just as a thoracic lesion may give symptoms like those of ruptured gastric ulcer, cholecystitis or appendicitis.

Reginald E. Smith[2] gives certain points which his experience has shown to be of value in distinguishing between true and false intra-abdominal catastrophies occurring as complications of influenza. (1) Movements of the alæ nasi: In the absence of other signs of thoracic disease, abdominal pain associated with movements of the alæ nasi during respiration indicates a thoracic and not an abdominal lesion. The movement of the alæ if not present can be brought out by slight exertion. Such movements of the nose come only in the latter stages of peritonitis, never early in the disease. (2) Dulness in the flanks never indicates a visceral inflammation with resulting peritonitis, except in the cases of acute hematogenous infection of the peritoneum. In these latter cases the localized pain and other characteristic symptoms of diffuse peritonitis are lost in

[1] Jour. Am. Med. Assn., March 22, 1919, lxxii, 880.
[2] Loc cit.

those of the severe general infection. (3) The facies is that of influenza, not of peritonitis. The anxiety is lethargic and resigned, not terror-stricken and active. It is of the medical rather than the surgical type.

One of our cases illustrates Smith's second point: The patient, a young colored woman, was admitted to Mercy Hospital with an influenza pneumonia. She had a temperature of 102.5° and was expectorating thin, purple sputum. She was intensely toxic and apathetic, but not unconscious. The chest signs were those of broncho-pneumonia. The abdomen was distended, there was shifting dulness in both flanks, with muscle spasm in the left upper quadrant. There was no edema and the urine was free from albumin and casts. Except for this muscle spasm there were no signs of peritonitis. The patient died about twenty-four hours after admission. We were unable to secure an autopsy, but it seems reasonable to conclude that the peritoneal exudate was the result of a general infection so overwhelming that the ordinary signs of peritonitis were lost.

Thrombophlebitis. The usual situation of an infectious obstruction of the bloodvessels is in one of the veins of the leg. Such a thrombophlebitis of the femoral vein may be the starting-point for an occlusive clot which will extend into the vena cava and over into the iliac vein of the opposite side. In addition to this form of abdominal thrombophlebitis it is known that thrombosis may begin in any branch and involve the cava by direct extension or that a primary thrombosis of the vena cava itself may occur, as a complication of one of the acute infectious diseases.[1] In one case we made the diagnosis of obstruction to the vena cava in the region of the hepatic veins. The patient was a young white man who passed through a severe influenza pneumonia. He was markedly cyanosed from the onset and suffered from girdle-like pains in the lumbar and epigastric regions. The intestines were considerably distended, and he was constipated. About the fifteenth day of his illness he developed ascites. The physical signs indicated a consider-

[1] J. H. Pleasants: Johns Hopkins Hospital Reports, xvi, 363.

able quantity of fluid in both flanks. The epigastric pain continued and there was slight tenderness just to the right of the vertebræ in the upper quadrant of the abdomen. There was persistent rise of temperature to about 102°. The skin of the abdomen and back was purple red in color. The patient gradually recovered. The fluid was slowly absorbed and the circulation in the skin gradually became normal. In this case collateral circulation must have been established by the deep channels, as in the case reported by Andrew.[1]

Coincident abdominal lesions include the perforative inflammation of the hollow viscera. In studying the cause of these perforations the case reported by Crowley[2] is worthy of consideration. In this case a patient, aged twenty-two years, died twenty-five days after the onset of influenza, which was complicated by pneumonia and empyema. At autopsy, among other lesions, there was found an ulcerative condition of the ileum, cecum and colon. The ulcerated areas contained a mycobacillus which was not present in the chest lesions. Crowley concludes that the organism is a cladothrix and that the chronic sepsis produced by the influenza and its complications so reduced the individual that an organism, ordinarily non-pathogenic, became invasive.

Beals, Blanton and Eisendrath[3] enumerate rupture of the rectus muscle as an abdominal complication.

We had no case of ruptured rectus, but had one abscess develop in the scar of an appendectomy which had been healed for nearly three years. The abscess came on during convalescence from the pneumonia after the patient had been free from fever for more than two weeks. It was situated in the rectus muscle outside the peritoneum. The patient recovered after incision and drainage of the abscess.

[1] Quoted by Pleasants, loc cit.
[2] Jour. Med. Research, January, 1919, p. 339.
[3] Loc cit.

DISCUSSION ON THE PAPERS OF DRS. RICHARDSON, SMYTHE, WILLIS, COWDEN AND McGLANNAN

Dr. R. S. Hill, Montgomery, Alabama.—In connection with perforation of the gastro-intestinal tract, I simply wish to report 2 cases of traumatic perforation that proved intensely interesting to Dr. L. L. Hill and myself.

The first case was that of a middle-aged man, very muscular, engaged in a lumber camp in the handling of logs. One of the logs fell across his abdomen. The lumber camp was about one hundred miles from Montgomery, and he was brought to the city eight or ten hours after the injury. There were scarcely any signs of external injury, but he was profoundly collapsed, and we felt there must be some serious injury internally. The abdomen was opened and we found a small circular opening in the small intestine. This perfectly round perforation of the small intestine was the only injury. It was closed and the patient made a tedious, though good recovery.

Within a year there was sent to us a boy, about ten years of age, who had been kicked in the abdomen by a mule the day before. There were no external marks or signs of injury, though his abdomen was very much distended and it was evident that acute general peritonitis existed. The abdomen was opened and found exactly what we found in the first case, a perforation of the small intestine. This perforation was perfectly round, and it was the only injury. To our gratification the little fellow recovered, though at the time of the operation the outlook was most discouraging.

These cases were intensely interesting to us. They must have been gas perforations and have taken place from within outward. In other words, they were blow-outs. The sudden blow on the walls of the bowel distended with gas caused the blow-outs. You have all had bow-outs in the inner tubes of your automobile tires. These cases emphasize the advisability of exploratory incisions after abdominal injuries.

Dr. J. Shelton Horsley, Richmond, Virginia.—I was particularly interested in the excellent paper of Dr. Willis, who has given us a very careful record of his cases. I believe what he

suggests as a possibility of benign tumors being the etiological factors in a certain percentage of intussusceptions is well worth thinking over. The pathogenesis of certain types of intussusception has not been well worked out. These cases sometimes come in groups. I have had 4 cases of intussusception in a period of four months. This happened four or five years ago, and I have had none since. In 2 cases I did a resection. There was no evidence of benign tumor found, though the specimens were not carefully examined.

I was impressed with the fact that it is safer, if you can do anastomosis, to resect the bowel if it is damaged than to reduce it, and resecting it will not only get rid of the tumor which may be present, but which you cannot see from the outside; but it gets rid of the diseased segment of the bowel. Death in these cases of obstruction is from enzymes or bacterial products generated in the traumatized section of intestine, and if you can do anastomosis it is better in the long run than to try to reduce the intussusception and leave damaged bowel. The 2 cases I resected got well. Of the 2 cases I reduced one was badly damaged and infiltrated; the patient had a high temperature within twelve to fourteen hours after the operation and died. All were infants.

As to perforations, I should like to speak of their treatment near the pyloric end of the stomach. Suppose there is a perforation in the ascending colon, we would not leave that and then do an ileosigmoidostomy, but go at the perforated bowel for two reasons: First of all it is simpler to excise the ulcer or perforation and suture, and, second, we know when there is infection we should limit our procedures to as narrow a field as possible and not open up anything else beyond the infected area for fear of spreading infection. What is usually done in perforation of the duodenum? The perforation is sutured, you narrow the bowel and this makes a posterior gastro-enterostomy necessary; then you may smear the septic material and exudate resulting from perforation of the duodenum into the lesser and into the greater peritoneal cavity, and you make an opportunity for infection to develop in a field that has been uncontaminated. Then, too, you suture the bowel through actually diseased tissue. I believe the preferable operation for this type of case is to excise the ulcer and do a pyloroplasty according to the technic I described before the last meeting of the Section on Obstetrics,

Gynecology and Abdominal Surgery of the American Medical Association. An incision is made a short distance into the duodenum, not more than an inch, and two inches or more in the stomach, midway between its borders. The stomach can be brought over without tension, the ulcer excised and the wound sutured transversely. In this way the operation is confined to infected tissue, the ulcerated part is excised and a wider opening results than before. Gastro-enterostomy answers in certain types of cases. Take those cases, for instance, in which there is marked fibrosis from an old duodenitis and it is difficult to mobilize the duodenum when there is no hemorrhage; in this type of cases gastro-enterostomy is satisfactory because you cannot bring back the upper duodenum that is extensively fibrosed to anything like the normal. Gastro-enterostomy here merely substitutes one unphysiological condition for another. When you have a perforation, if you can do a pyloroplasty it is not only simpler, but the late results will be better. Dr. Smithies reported 273 cases collected from the Mayo and Augustana clinics in which gastro-enterostomy had been done for various diseases. After going over the cases carefully he found that tuted the mortality was small the complaint-free cases constiwhile only 20.9 per cent. of the entire group.

One other point: If you had a bladder wound and wanted it to heal what would you do? You would keep the urine in a normal physiological state, and that is acid. In gastro-enterostomy the acid stomach contents is dumped directly into the jejunum, which is accustomed to containing alkaline contents. Trouble, such as inflammation of the jejunum and the formation of jejunal ulcers, must often follow as a protest against this change.

Dr. Major G. Seelig, St. Louis, Missouri.—I should like to say a word or two by way of caution concerning the Rammstedt operation. In reviewing the technic of this operation as described and the contra-indications, one gathers the opinion that it is a simple operation, and on account of its extreme simplicity one does not gather the fact that it is a rather treacherous procedure.

I did not have the privilege of hearing Dr. Smythe's paper, but I have no doubt his failure was due to the incomplete division

of the stenosing mass. Pyloric stenosis of the congenital type is due to marked connective-tissue hyperplasia circumferentially around the pylorus. The Rammstedt operation is devised on the basis of dividing this. If any of this hypertrophic bobbin is left intact there remains just as much obstruction at the pylorus as if one has left the entire mass of cicatricial tissue. Therefore the fundamental principle involved is to divide it all down to its shaving razor edge at the duodenum and pyloric end. The duodenum in a child is very thin, and in the last case on which I did a Rammstedt I went prepared with about six knives, all of which cut by their own weight. I lost the baby in the face of a flattering comment of a pediatrician, who said it was the only real Rammstedt operation he had ever seen done, and at autopsy I found a little leak. I had gone through the duodenal mucosa, in spite of being on the lookout for this accident. One finds himself between the Scylla and Charybdis of incomplete division and too complete division with leakage, and it is just as well to know this when you tackle the operation. I am not prepared to say it is not a logical operation, and I am not prepared to say I shall continue to do it, but I am prepared to say I do not sleep well after it is done until I am pretty sure things are all right.

Regarding one other statement, Dr. Willis would have us believe that the Fowler position is an accomplished fact and beyond the pale of discussion. I doubt if I have used the Fowler position in the last three or four years, and I am eminently satisfied with the change. My patients assume the abdominal posture, and the reason is this: The syndrome known as acute dilatation of the stomach has only one definite, constant accompaniment. The causation is more or less in doubt, but all the cases that have come to autopsy have shown that the small intestine gravitates into the pelvis, with consequent traction on the mesentery, and secondary to that, traction is exerted through the superior mesenteric artery, which pulls down on the duodenum and starts a vicious circle going. The only relief for this, aside from operation, is postural relief. Much of postoperative vomiting referred to other causes is due to the Fowler position. I have been able in some cases to bring on acute dilatation and relieve it simply by putting the patient in the Fowler position or taking him out of it. Since using the abdominal

position (and I speak within the limits of truth when I say that most St. Louis surgeons use it) we have had better results. Furthermore, I may say that it is very questionable whether all the work done on the heightened absorbability of the upper abdomen compared with the lower will bear close investigation, and whether or not we have not been wrong in our assumption that the upper abdomen absorbs so much more rapidly than does the pelvis.

Dr. Willard Bartlett, St. Louis, Missouri.—I believe it is time for us to come to a showdown on the Fowler position. Dr. Seelig has opened the ball, and what I am about to say is not intended as a carping criticism, but our friend from Nashville (Dr. Cowden) spoke of nine patients who got well from what he did and by the use of the Fowler position. The probabilities are that an equal number of patients would have recovered from what he did without the use of the Fowler position. I have not used the Fowler position for two or three years, and I do not think anybody will, if he will take Hertzler's classic book on the peritoneum and read it. Dr. Fowler did not propose the so-called Fowler position for drainage purposes at all. There is no word about peritoneal drainage in Fowler's original paper. That struck me with great force when I read it in Hertzler's book.

Another thing: Drainage in the Fowler position is added to the original statement by the older commentators, based on the principle that fluids run down hill into the pelvis, which is not so. Posture has been tried time and again expermentally on animals and on the human subject, and it has been shown that fluids are not influenced by gravity in the peritoneum. It is a physiological matter, just like the progress of fluids through the intestinal tract. I think Dr. Cowden is wrong in his reference to the upper abdomen if he meant anything by fluids going up through the diaphragm, as they do not go in that direction. Fluids are absorbed from the peritoneum at only one point, that is, from the peritoneum surrounding the root of the mesentery. They go into the lymphatics between the layers of the mesentery and are there carried farther in the ordinary way through the lymphatics. Hertzler proved it in many cases experimentally, and quoted an enormous amount of proof to substantiate the

same thing. There are many reasons for not using the Fowler position. It is not a suitable posture for a patient with a damaged heart, for one thing.

As to the treatment of peritonitis, Dr. Cowden called attention to the use of morphin. Peritonitis is treated in only one real way, namely, by putting the intestinal tract at rest. One must give the physiological amount of fluid, and I accomplish it by the hypodermic method. Take a can of 700 c.c. or 800 c.c. filled with water; put in that a grain or half a grain of morphin, and put in 15 drops of adrenalin. The blood-pressure of these patients is always low and you want to hold it. Adrenalin is evanescent, but it will last an hour or two in a can of fluid. Give that and watch the patient for lowered respiration. As to gall-bladder perforations, I do not think they are rare in St. Louis. I had three in the hospital at one time a week before I left home.

Dr. John Wesley Long, Greensboro, North Carolina.—Undoubtedly ileostomy is a life-saving operation. I am sure that every surgeon has signed death certificates of one or more patients because he did not do an ileostomy. I want to show you a standardized method which I presented to this Association a number of years ago for doing ileostomy. I have done over 100 of these operations. I cannot analyze the statistics because of a lack of time. I purpose doing that later. The first thing after exposing the distended gut is to introduce a purse-string suture in the bowel. The opening in the bowel is made with the thermocautery, which seals the bloodvessels, prevents hemorrhage and limits the spreading of infection. A tube is then placed in the bowel and the purse-string suture tied around the tube. Usually, and whenever it is possible to do so, I introduce a second purse-string suture, which inverts the intestinal edge a little more and makes it more secure. I should like to call your attention to a matter which I emphasized at the time I presented my paper, and that is the value of bringing the omentum snugly around the tube over the intestine and under the parietal peritoneum. That is the greatest possible safeguard to prevent leaking of the opening into the bowel, either while the tube is there or later. The enterostomy opening, which is surrounded by the omentum in this manner, very frequently closes within twenty-four hours after the tube is withdrawn. I have had a number of these

cases that did not leak one single drop, because as soon as the tube was withdrawn the omentum would automatically close the opening.

Dr. Francis Reder, St. Louis, Missouri.—I am prompted to take the floor by the remark of Dr. Long, when he stated he had performed ileostomy 100 times. I wondered what happened to the patients, not what Dr. Long had done to them, but what created the condition that he should have had occasion for performing ileostomy so frequently. It is true we are sometimes overanxious about our patient who presents symptoms of partial intestinal obstruction, and, fearing that such partial obstruction may eventually develop into a complete obstruction, we are prompted to perform ileostomy. As Dr. Long has rightfully said, performing ileostomy at the proper time perhaps accounts for the large number of operations that have been performed.

Dr. Richardson's paper touches one of the most interesting chapters in abdominal surgery. I presume that he has had his share of menacing cases, such as gangrenous appendices, pus accumulations, etc. Formerly, when we were wont to use tubal drainage, we rather frequently encountered intestinal obstructions. Later on, however, when we fully recognized the danger of a tubal drain and substituted a less harmful drain, such as a rubber dam, these obstructions became less frequent. Again, even in those cases in which no pus was found, the operative measure having been instituted simply for ablation of the appendix, it sometimes necessitated severe handling of the viscera, causing symptoms simulating obstruction to evidence themselves a few days later. This condition, however, was mostly of a mild nature and therapeutic measures usually gave relief. Pituitrin in these cases has served me well.

I cannot speak as encouragingly of my cases of ileostomy as some of the other gentlemen who have taken part in this discussion. I have had 4 such cases and presume that I did not perform the operation in time. The patients all perished. There is a period of anxiety following a laparotomy that can be properly termed the surgical crisis, which lasts from three to five days. If during this time you have been able to establish a satisfactory bowel evacuation much of your anxiety will be relieved. If, however, you have not succeeded a certain amount

of doubt will cloud the patient's condition. Under these circumstances the respiratory movements, the pulse-rate and the abdominal distention must be interpreted correctly, that valuable time will not be lost in instituting proper surgical measures —Dr. Long's ileostomy, for instance.

Dr. McGlannan's paper on influenzal chest lesions complicated with abdominal symptoms carries us back only a few years when abdominal pain simulating acute appendicitis, concomitant with an existing pleurisy or pneumonia, was interpreted as a true lesion and was invariably attacked surgically. This does not happen now because the condition is better understood. When surgeons accepted the diagnosis of appendicitis, usually made by an internist, and operated, the operation usually failed to disclose a classic pathology of the appendix, and in reality negatived the operation. This proved an interesting lesson and has made surgeons very careful in operating for appendicitis when a chest lesion also is demonstrable.

A MEMBER.—I should like to discuss just one point in Dr. Cowden's excellent paper on perforations. Dr. Cowden said we should close the perforation of the intestine in the best way possible that would not obstruct the lumen of the bowel.

I think there is one point well worth bringing out in the technic of the closure, and that is that all perforations of the bowel should be closed in only one way—they should be closed in the direction of the transverse axis of the bowel and by continuous suture. Some of the work done on dogs some years ago brought this out very strikingly, and it is supported by the law of hydrodynamics. According to the law of hydrodynamics the bursting pressure within a tube circumferentially is three times that of the longitudinal pressure. The only pressure to which the closure of a hollow viscus is subjected is that longitudinal pressure which carries all the fecal and gaseous contents, and that pressure is threefold in a circumferential direction. If we close a perforation in a hollow viscus parallel to the longitudinal axis of the bowel our closure will be subjected to a force which will tend to open it. If we close it by a continuous suture, that is, transverse to the axis of the bowel, the pressure to which our closure is subjected tends to stretch the longitudinal closure, and when our continuous suture tends to draw tight it should close the line of suture.

Dr. Joseph Ransohoff, Cincinnati, Ohio.—In corroboration of what some of the gentleman have said in regard to the Fowler position it was formerly customary in most institutions to have the Fowler bed prepared for the patient in his room while the operation was being completed, and the patient was moved right to the bed from the operating table. That practice has been given up. I am glad Dr. Seelig suggested one thing, and that is the condition of the heart in operative cases, particularly those that have undergone long operations. I have seen a number of cases in which the patient's condition was jeopardized by the Fowler position and began to improve as soon as removed from this posture.

We all know of the difficulties in diagnosis, particularly in children, where we think there is peritonitis, when in reality there is no peritonitis. That is quite a common observation. We think we have pneumonia to deal with in children which simulates very much indeed the question of peritonitis. The rule has been laid down, particularly by Murphy, that as soon as you make a diagnosis you should operate. I remember very well Dr. Murphy's discussion at Columbus, Ohio, before the Surgical Section of the American Medical Association. He stated at that time that when we make a diagnosis of appendicitis we should operate at once no matter what the stage of the disease is. This was a very remarkable discussion and occurred a number of years ago when the subject of appendicitis was a new one. Dr. Murphy, with his usual vigor, said that he would operate on any case of appendicitis as soon as the diagnosis was made, and it was the rule to which he made no exception. Immediately after he sat down, Dr. Graham, of Chicago, arose and said: "Mr. Chairman, the gentleman who has insisted on operating as soon as the diagnosis is made does not always operate." This was a direct challenge which Dr. Murphy took up at once, and said, "Does the gentleman allude to me?" Dr. Graham replied, "I do." Dr. Murphy said, "Can you mention any instances?" Dr. Graham replied: "I can. You were called to see Mr. John Smith, 702 Prairie Avenue, Chicago, and advised against operation." It seems Dr. Graham had a list of cases in which Dr. Murphy had counseled delay. He knew what Dr. Murphy was going to say, and Dr. Murphy said at the time that he had changed his opinion since then. Dr. William J. Mayo,

who was chairman of the section at that time, no doubt remembers the discussion.

I do not think it does any harm in some cases in which we are doubtful as to the diagnosis of appendicitis in waiting twenty-four to forty-eight hours. Patients are operated on now three or four days after the diagnosis is made, even when there is perforation, and they get well. I should like to ask how many of you have lost cases of acute appendicitis in the three or four days you have waited. If there is any doubt at all, by that time the physical signs of a pneumonia are all there and are easily recognized.

There is one point I wish to call attention to. In every case in which I suspect an acute abdominal lesion, like the gall-bladder or appendix, when the patient is under the anesthetic the corneal reflex is just about gone, I try to corroborate the diagnosis by making deep pressure. If I do not get a reflex, as one reflex is shown by deep inspiration, by change in the pulse-rate as one irritates the cornea, I am in great doubt as to the correctness of the diagnosis. I never feel in cases of appendicitis or gall-bladder trouble I am not going to get these changes on pressing deeply while the patient is nearly completely under the anesthetic to determine whether or not there is something there, and by making pressure I get that reflex. I mention this point in the way of helping to make the diagnosis.

Dr. W. R. Jackson, Mobile, Alabama.—In regard to Dr. Richardson's paper on the subject of ileus following appendicitis or hysterectomy or any abdominal operation, I am particularly interested, for the reason that in the last two weeks I have operated on three cases, all "perishing," as Dr. Reder says. It was stated by Dr. Long that ileostomy is a life-saving measure. I should like to ask three questions: First, if, when the ileostomy is done, has the primary obstruction been relieved? Second, Is simply ileostomy done and the patient left to his destiny? Third, Is he drained with Jacobson's tube through the thermo-cautery incision and no obstruction relieved?

I have done all three. I have relieved obstruction, drained the gut, sewed it up, dropped it back and the patients have died. I have relieved the obstruction, did ileostomy, anchored the gut, drained it with a tube and the patients have died. I have

resected the bowel, anastomosed it and drained and the patients have died. Professor Moynihan tells us why we have all these patients die. First, he tells us that we do not operate upon them soon enough. We cannot always do that. Second, he tells us we do not get the toxic material out of the bowel. We simply make a hole in the gut, put a large tube in it, drop it back, the gut is paralyzed, the toxic material is absorbed and the patient with a perfectly normal sensorium, within an hour, is dead from sapremia, indol, skatol or some other kind of poison. What is the remedy? You open up the gut and use a long tube; you have tried to express the fecal contents from the intestine when very large. You put in a big tube and start milking out from the distended gut and you try to produce very thorough drainage. If you get out all of the fecal contents and put back the gut, what is the destiny of the patient? If the case is one of long standing the patient is going to die. Three days will sound the death-knell of nearly every one of them.

In regard to perforations from ulcer, nearly always these perforations are like the craters in a volcano, surrounded by lava, inflammatory exudates, infiltrates and hard masses. You commence suturing the bowel and the sutures pull out. Inversion is impossible very often, so you do the best you can, coapt the edges and put in two or three sutures, and you are not certain whether they will hold or not. In addition to the omental covering a big tubular drain is my practice

Dr. Walter C. G. Kirchner, St. Louis, Missouri—I was particularly interested in the paper of Dr. Willis, having had experience with that type in which fibroma or fibro-adenoma was found at operation. The patient, as is usual in these cases, comes to the hospital with symptoms of obstruction, and in this particular instance was in a severe state of collapse. There were certain symptoms, such as hemorrhage from the bowel, that pointed to intussusception, and the operation was undertaken with that condition in view. Intussusception was found, which was relieved in the usual way by compression, and a mass was found in the lumen of the intestine, through an incision in the intestine; this mass was removed, which upon pathological examination proved to be a fibro-adenoma.

The essayist went very carefully into the explanation of this

intussusception, and to my mind he has satisfactorily explained the condition. In this instance the tumor was at the apex or beginning of the intestinal portion as it descended into the bowel, and no doubt contributed to the formation of the intussusception. I did not perform ileostomy in this case, the condition being so easily relieved. However, the paresis of the bowel persisted and the condition of the patient was such that she died a day or two later. I report this case as one of those in which a fibro-adenoma, a benign tumor of the intestine was the cause of obstruction and this condition which should not be overlooked in making a diagnosis of intestinal obstruction.

The paper on perforations was very interesting to me also. It cannot be discussed to the fullest extent on account of the limited time, but there are a few points in regard to the diagnosis which might be mentioned. Perforation from appendicitis and from typhoid is well understood, but in the cases of duodenal and gastric perforations I have encountered I have noticed the patient gave a history of feeling as if fluid were escaping, but by the time he arrives at the hospital the pain is frequently in the appendicular region, and it is difficult to make a diagnosis. I believe the pain in this region is due to an advancing peritonitis. In the beginning the pain is localized and is in the gastric and duodenal region but as the peritonitis spreads we have the pain at the circumference of the inflamed area, so that whereas in these cases of perforation in the upper quardant there may be localized pain in the appendiceal region where the perforation is bad. It is important to bear this in mind because it helps us to decide where to locate the incision. I have tried local anesthesia in these cases, but I would discard it in favor of general anesthesia. We require quick work, and we can perform the operation so much better under a general anesthetic. I have even irrigated under local anesthesia, and I am convinced that irrigation when we have perforation is a harmful procedure and should not be done. The simpler the operation the better.

Dr. Randolph Winslow, Baltimore, Maryland.—I should like to mention one point in regard to the treatment of perforations of the stomach. Someone has said here, if I understood him rightly, that such cases should always be treated with gastro-enterostomy in addition to suturing the opening in the stomach.

I am inclined to doubt that very much, and for this reason, that upon one occasion in which I performed gastro-enterostomy for ulceration and perforation of the stomach the patient died and I had the opportunity of examining the opening of the pylorus subsequent to death. I had done gastro-enterostomy because I thought there was too great a narrowing of the pylorus produced by the suturing of the opening. After the death of the patient I had the opportunity, as I have stated, of examining the stomach and of putting my finger into the pylorus where it went easily, and which would have done perfectly well without a gastro-enterostomy, and in that particular case, probably, the man would have recovered if the gastro-enterostomy had not been done.

Dr. William T. Black, Memphis, Tennessee.—In speaking of benign tumors of the intestine I wish to cite a case which occurred in March of this year of fibroma about the size of a walnut growing from the end of a Meckel's diverticulum. The case occurred in a woman, aged forty years, who had a mass about the size of an orange in the right abdominal region in the neighborhood of McBurney's point. This mass had existed for two or three weeks prior to her entrance to the hospital and was proved at the time of operation to be simply an inflammatory mass resulting from the appendix. In examining the first portion of the ileum, which I usually do, I discovered a tumor about the size of a walnut growing from a Meckel diverticulum. It was very much reddened and proved to be a fibroma.

I simply mention this case because I think, unless there is some contra-indication in the way of pus or a gangrenous appendix or a perforation of a viscus, or some other contra-indication, we should make a routine examination of the small intestine and other intra-abdominal organs at the time of operation.

I reported a case before this Association, at its last meeting, of a large tumor (about nine pounds) which grew from the end of a diverticulum of the colon.

Dr. I. S. Stone, Washington, D. C.—As a rule secondary operations are unsuccessful whether done for acute or chronic conditions. The cause of this may be due to hasty action on the part of the surgeon who has administered purgatives very

early after operation. Everyone of us can remember when the routine practice was to give cathartics, such as calomel and salts or other drastic purgatives, on the second day after operations. Some even going over the mark gave castor oil while the patient was still on the operating table, using a stomach tube for the purpose. Now many of us delay the use of purgatives until the bowels have responded to the use of enemata and then avoid all of the drastic remedies, giving the preference to peristaltic stimulants, such as senna and cascara. We have had entire satisfaction with this simple treatment and do not hesitate to wait until the fourth day to give a laxative, and frequently patients leave the hospital without having had a purgative by the mouth. I believe a very good way to induce ileus is to follow the former practice. The peristaltic stimulants, eserin, pituitrin and peristaltin, given hypodermically, have often been effective auxiliary agents, and I have yet to see any ill effects from their use in my practice.

Dr. Joseph A. Danna, New Orleans, Louisiana.—I want to say a word or two in answer to Dr. Ransohoff. He advocates waiting when we are in doubt as to whether a patient has an abdominal or chest lesion. I think I can best illustrate my point by citing a case that happened recently. I saw a little girl, three years of age, who was taken sick at 8 o'clock in the morning, without any previous symptoms, with an acute abdominal pain, and, remembering the fact that in children especially it is hard to tell whether an abdominal pain is due to a chest or abdominal condition, I examined the chest thoroughly. Not satisfied with my own negative findings I had a pediatrician and a medical man also examine the child, and they both told me they could find nothing in the chest. I operated on this little girl before 12 o'clock, less than four hours after the first pain; the child's abdomen was filled with pus and the tip of the appendix was gangrenous. If in this case we had followed Dr. Ransohoff's advice and waited until the next day I am afraid we would have waited too late, because the child was already very sick.

Another point I should like to make is that I am glad that morphin has finally come into its own. Some of you will probably remember when the Southern Medical Association met here last that I got up and advocated the free use of morphin, in

acute abdominal troubles and was hooted down. I have been hooted down at a number of other medical meetings because I advocated the free use of morphin in acute abdominal conditions, both before operation and after operation. If the gentlemen who are doing so many ileostomies will use morphin freely after operation from the moment the patient first wakes up and follow the rule I do of going into the room and telling the patient in the presence of the nurse: "You holler, if you have any pain; make lots of noise, so they will do something for you," then perhaps they will not have so many ileostomies to do.

Dr. E. Denegre Martin, New Orleans, La.—While we have been discussing these papers from various standpoints not a word has been said with reference to surgical judgment and common-sense. It seems to me there are two schools here today, one advocating drainage and the Fowler position while the other school is opposed to it. Perhaps my friends from St. Louis are doing better work, and that accounts for their success. While I am not one of those who believes the Fowler position a necessity in all cases, yet when I find the pelvis full of pus I believe it wise to drain it out in that way. After all it is largely a question of long experience and good surgical judgment in these cases. Within the last few months I have had two cases of duodenal ulcer, both of which were perforated, and both patients got well. One patient was put in the Fowler position and one was not. The first one had no free contents in the abdominal cavity; the condition was localized; I got the patient in time and had no trouble. I cut off the pylorus, did a gastro-enterostomy and the patient made an uneventful recovery. In the other case the abdominal cavity was full of gastric contents. I got six ounces of fluid out of the pelvis by putting the patient in the Fowler position and siphoning from a Murphy tube. He has made a complete recovery. I did a modified Heinecke-Mikulicz after dissecting out the ulcer. The aspiration and a better technic will, of course, make this unnecessary in many cases, but these are at present the exception rather than the rule.

Dr. Frank Martin, Baltimore, Maryland.—I wish to enter a protest against gastro-enterostomy following operations for the repair of perforations of duodenal and stomach ulcers. I

published sometime ago in the *Annals of Surgery* some twenty odd acute perforations, and in none of these did I find it necessary to do gastro-enterostomy as a need for the recovery of the patient. The vast majority of cases recovered and since then I have done ten others. In none of these cases was there any need for gastro-enterostomy. I think the whole picture of stomach perforation, the syndromal symptoms are so definite—the acute, sudden onset of pain, with the evidences of peritonitis are so clear that early operation is indicated in all these cases; and the sooner you can possibly go in, whether you are able to close the perforation or not, and give them thorough drainage, both in the lower and upper abdomen, so much better are the chances of their recovery. I have never yet found it necessary to switch around and do a gastro-enterostomy.

Dr. Smythe (closing the discussion on his part).—I was deeply interested in Dr. Cowden's paper. His remarks were convincing and to the point, and I approve of practically everything he said. Much time is often lost in a discussion with some consultants in an effort to determine the particular viscus responsible for an obvious peritonitis. The time thus consumed could be more profitably employed in operating and trying to save the life of the patient. In some cases the viscus at fault can be determined before the operation—in fact in the majority of cases—if an accurate history of the case be obtained plus a careful physical examination; the operation confirms the preoperative diagnosis. The chief pathology is always found at the point of most severe pain upon pressure. The chance of operating upon an acute abdomen and finding no pathology is a very remote one. Should the case prove to be a pneumonia, with referred pain, the surgeon stands convicted, generally speaking, of lack of thoroughness upon his part before operation. The pneumonia could have been detected by examination prior to the operation just as readily as at the operation. Such mistakes, however, have been made, and they occur most frequently in children, or when operating for suspected typhoid perforation; hence we must be on our guard at all times and never act hastily when a shadow of doubt exists as to diagnosis.

As to the advisability of operating in cases of acute appendicitis: one is rarely, if ever, justified in following the plan suggested by Dr. Ransohoff. Such a procedure is extremely

hazardous, and I believe the safest plan is to operate just as soon as possible after a positive diagnosis has been made. The best treatment for peritonitis is surgical prophylaxis; that is, removal of the cause, which, if left unmolested may eventuate in peritonitis. When peritonitis exists we have a very serious condition to deal with regardless of the plan of treatment adopted, and the mortality attending it is rather high. A surgeon cannot tell beforehand what the operation will consist of upon entering the peritoneal cavity for general peritonitis, but the principal pathology should be removed, when possible, and with the infliction of as little trauma as possible. The surgeon should enter the abdomen quickly, do what he thinks necessary, and no more, and get out without taking needless excusions.

Internal obstruction not infrequently is the result of or due to an infection. Ileostomy has not proved very successful in my hands in saving cases of intestinal obstruction due to general peritonitis. The drainage alone and the escape of gas has not met the requirements. Death in my opinion results from toxemia or streptococcemia, and not because of the fact that the intestine is obstructed. Many of the cases that recover following ileostomy probably would have recovered without the operation; and yet the surgeon feels impelled to do ileostomy after other measures have been tried and failed. In the absence of something better I will probably continue to do the operation in certain cases.

Dr. Richardson (closing the discussion on his part).—I regret that my patients did not have the benefit of the technic suggested by Dr. J. W. Long, but the cases were done before I was familiar with his method. I am fully in accord with Dr. Stone in that a most important thing to guard against the development of obstruction is the avoidance of active catharsis during convalescence. I did not intend to advocate enterostomy for the paralytic type of obstruction occurring during the first week after operation, but from many large clinics, statistics show in cases of appendectomy requiring drainage a small percentage, 1 or 2 per cent., in which obstruction, apparently mechanical in nature, occurs somewhat later in convalescence. The mortality in this class of cases is high. These cases develop under the surgeon's eye, and we have not the *alibi*, as is frequently the case in obstruction occurring spontaneously, that

they were not referred early enough for successful operation. In such cases when we can exclude sepsis, and there is active peristalsis, due apparently to mechanical obstruction, there is a place for ileostomy. The danger is not so much in doing it in too many cases as it is in doing it too late. A point we do not know is how often an ileostomy will close spontaneously when done for this type of obstruction. The fact that there are so few statistics on this point has been my principal reason for presenting these cases.

Dr. Cowden (closing the discussion on his part).—I think the Association is indebted to the St. Louis delegation for their remarks on the Fowler position, and with much pleasure we will take home with us what they have said. Dr. Reder says that in St. Louis these patients perish, while our friend Dr. Jackson said that in Mobile they die. We are indebted to the gentleman from St. Louis for that term. It sounds good to me.

In regard to the Fowler position, I know there has been a tendency at times to swing away from it, and I believe the pendulum will swing too far on the other side, as it has done in the past. But I am one of those who is not quite ready yet to give up the ship that has many a time tided me over. I believe yet there is a place for the Fowler position in the treatment of these conditions, and that it subserves a good purpose. I want to emphasize the point that the patient is much more comfortably placed than if on his stomach. I do not know of a more unpleasant position than that mentioned. If a patient has been up for a while in the Fowler position and you put him down he will complain that he is not so comfortable as he was in the mild, but not exaggerated, Fowler position.

As to the closure of the openings in these perforations they are very easy to close in the majority of cases. They are all very small, and while they are surrounded by an indurated area, it is surprising how easily they can be closed. If necessary we can use a little omentum to seal over the opening and keep it closed in that way.

As to the suggestion of waiting in cases of appendicitis, there is a class of patients we have to deal with in which is necessary to wait. I believe with Murphy, that as soon as a diagnosis of appendicitis is made we should operate; but sometimes we get hold of a patient who is not ready for operation. If you do not

take my suggestion, and have a little bit of patience with these patients, you can note the symptoms, and I think it is always right to wait if the cardinal symptoms are not exaggerated. Take any one of the cardinal symptoms in appendicitis; if they are exaggerated we jeopardize the life of the patient by waiting. If you have a great deal of pain, if you have a board-like rigidity or if you have a great deal of vomiting with these conditions, if any one of the cardinal symptoms is exaggerated, operate. Especially is this true with the rising of the pulse. No matter if the other symptoms are subsiding, if the pulse-rate is going up you can predict to a certainty that your patient is going to the bad. If you examine the patient an hour or two after that and find the pulse-rate is climbing, if they will not let you operate let them get another doctor.

In doing gastro-enterostomy in these cases we are not justified in doing it unless we find the pyloric end closed, and then we very seldom do it. The object is to get in and do as little surgery as you can, get out, and do ideal surgery subsequently. Patients come to us not for stenosis of the pylorus but for perforation, and I take it there will be few patients who will demand one of these posterior gastro-enterostomies.

Dr. McGlannan (closing the discussion).—I should like to ask Dr. Ransohoff how often his examination under ether anesthesia gave him information sufficiently definite to lead him to abandon the operation. My own feeling is that most of us after having our patients under an anesthetic, would be tempted to look in. That temptation would be irresistible. Probably just as good information can be obtained by blocking the nerves, as suggested by Reginald Smith, thereby avoiding the administration of an anesthetic to a sick patient.

Dr. Joseph Ransohoff, Cincinnati, Ohio.—Dr. McGlannan misunderstood my previous remarks. I never fail to open the abdomen in these cases. Sometimes when my diagnosis is a little shaky I do not operate as promptly as I otherwise would. In regard to waiting until a correct diagnosis is made, it is an unusual thing. I do not suppose this happens once in three years where I would wait before operating. It is in the doubtful cases in which we make mistakes in opening the abdomen when the trouble is in the chest.

GUNSHOT WOUNDS OF THE BRAIN WITH RETAINED MISSILES

By Charles Bagley, Jr., M.D.,
Baltimore, Md.

The present report is an attempt to show what might be called the late results of metallic foreign bodies in the brain. During the period of the war numerous communications set forth methods of handling cases of this sort at the primary operation immediately after the injury. Removal of the foreign material at the primary operation was universally advised, if it could be accomplished without undue risk. As a result of the attempt at immediate, complete removal, a large majority of the patients returning to this country with gunshot wounds of the head presented scars of varying degree without foreign bodies in the brain.

In a series of 192 patients with head wounds, which, except for a few accidents, were war injuries, 42 had metallic foreign bodies intra- or extracranial; 33 of the cases may be disregarded, as the metal was superficial or in small particles, so that only 9 had retained metal of sufficient size and at a sufficient depth to demand serious consideration. These cases, with an additional civilian with a retained pistol bullet, form the basis of this paper.

In reviewing the publications concerning primary operations, Dr. Harvey Cushing's paper[1] offers the best data for comparison. Accurate comparison cannot be made, since the

[1] British Journal of Surgery, 1918, vol. v, No. 20.

series on which his data were based consisted of 219 cases while our series numbers 192; but it is interesting to note the relative difference in the number of wounds of this type, the primary series furnishing 76 against 9 in the secondary series. These 9 cases are grouped according to the classification of the primary series into Grades V, VI, VIII.

Six of the patients of the secondary series were in Grade V, namely, wounds of penetrating type, with lodgment both of projectile and bone fragments. In the primary series there were 41 cases in this grade. Five of the secondary cases, Cases 1, 2, 3, 5 and 7, were operated on and recovered; the other patient, Case 9, was discharged without operation because of the inaccessibility of the missile and the fact that it was not causing symptoms.

Two of the secondary cases were in Grade VI, namely, wounds with ventricles penetrated or traversed (*a*) by bone fragments and (*b*) by projectile. In the primary series there were 30 cases in this grade. One of the secondary cases, Case 6, wounded September 29, 1918, was operated on July 14, 1919; two large bullet fragments were removed and when cultured gave Staphylococcus growth. During a second operation, November 26, 1919, for the removal of another fragment, a large cyst in the frontal lobe was opened; the cyst communicated with the ventricle and cultures gave growth of Staphylococcus albus. The patient died on January 10, 1920. The other patient of this grade, Case 8, wounded July 4, 1918, was operated on June 5, 1919, for the removal of bone fragments from the left occipital lobe. A shell fragment in the left cerebral peduncle did not seem to be causing symptoms and was inaccessible, so that no attempt at removal was made. The fragments removed gave Streptococcus hemolyticus growth, and the patient died on June 25, 1919, of septicemia.

The number of secondary cases is too small to permit of comparison of mortality percentages, but it is interesting to note that the most serious grade in the primary series was the only grade in the secondary series in which there was mortality.

One of the cases of the secondary series was in Grade VIII,

namely, wounds with craniocerebral perforation. In the primary series there were 5 cases in this grade. In one case (Case 4) the wound of entrance was in the right occipital lobe, from which location a large shell fragment was removed immediately after the injury. In the left temporal region there was a small skull defect, evidently the point of exit of some portion of the shell, and near which lay the small shell fragment which we removed.

In the experience of those doing primary operations at the front, infection caused chief concern in the patients not mortally wounded. In the primary series it was not possible to make cultures of all projectiles removed at operation, but in the several of which cultures were made all showed organisms of greater or less pathogenicity. In the patients of this series, all of whom were operated on many months after the injury, infection was still the condition causing greatest trouble. In 7 cases the foreign body was removed and cultured; in 4 of these there was bacterial growth in the cultures; in 3 the cultures were negative. In another case in which there was no attempt to remove the metallic foreign body an abscess at the site of the bone fragments was drained, cultures from which gave bacterial growth.

Organisms were found in various stages of activity, ranging from the entirely dormant stage, Case 6, through the small abscess not causing symptoms, Case 1, to the large abscess, with prominent pressure symptoms, Case 2, and the abscess with pressure symptoms and septicemia, Case 8.

It has long been recognized that the mere presence of a foreign body in the brain is not incompatible with life, nor does it necessarily disturb function. In the reconstruction work, however, it was planned to have all soldiers discharged in a condition as nearly normal as possible. The patient was always desirous of having foreign material removed from the brain if it could be accomplished without undue risk. In some instances the removal of the foreign body was necessary as a preliminary to the repair of skull defects, as it is unwise to repair defects if the brain contains foreign bodies.

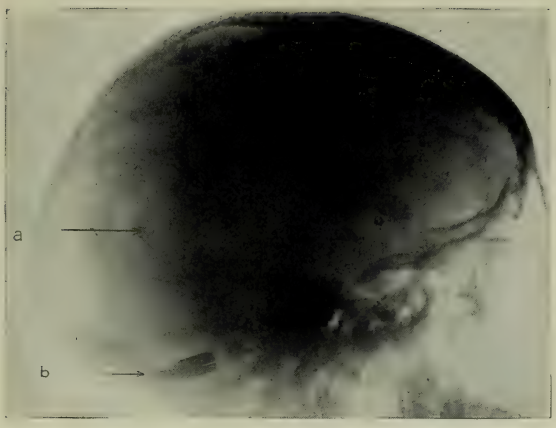

FIG. 1.—Case 1. *A*, point of entrance; *B*, machine-gun bullet in right cerebellar hemisphere.

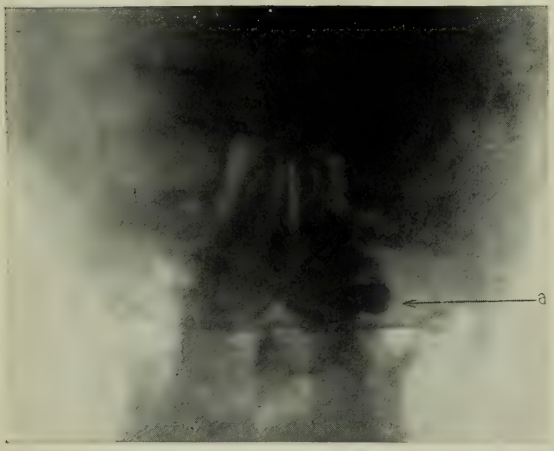

FIG. 2.—Case 1. *A*, machine-gun bullet in right cerebellar hemisphere.

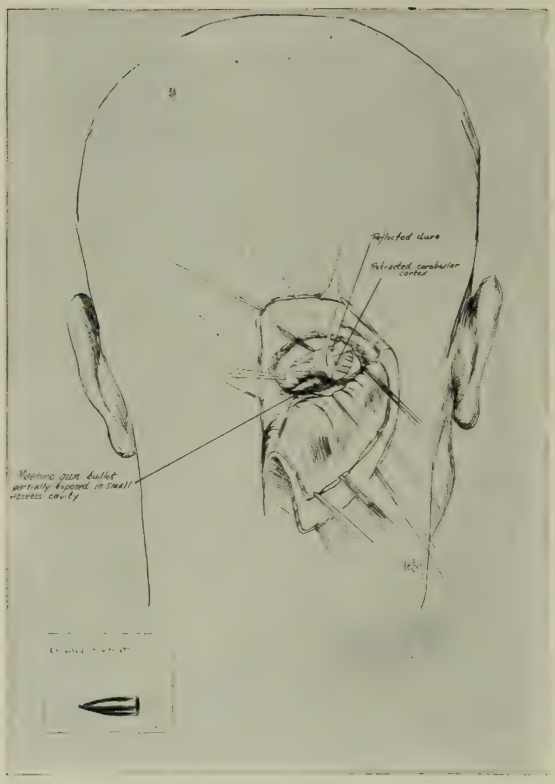

FIG. 3.—Case 1. The sketch shows the portion of the bullet which projected into the abscess cavity.

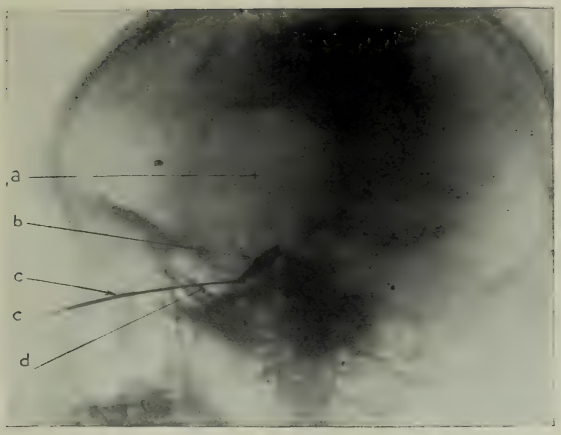

FIG. 4.—Case 2. *A* marks the center of a skull defect, the result of the left subtemporal decompression; *B*, shell fragment in middle fossa of skull; *C*, probe passed through the sinus, beginning in the malar region and extending to the shell fragment; *D*, floor of the middle fossa of the skull.

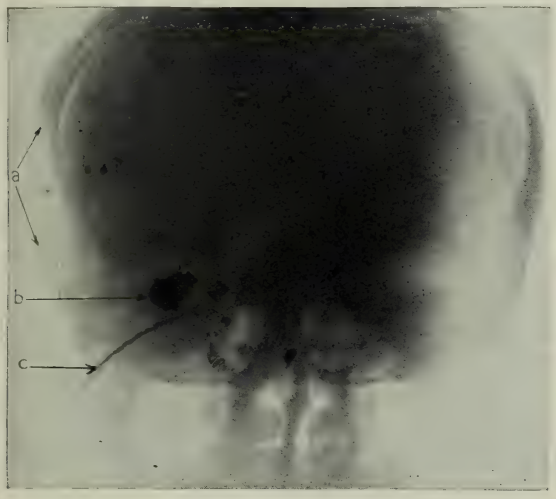

FIG. 5.—Case 2. *A* marks the skull defect, the result of the left subtemporal decompression; *B*, shell fragment in middle fossa of skull; *C*, probe passed through the sinus, beginning in the malar region and extending to the shell fragment.

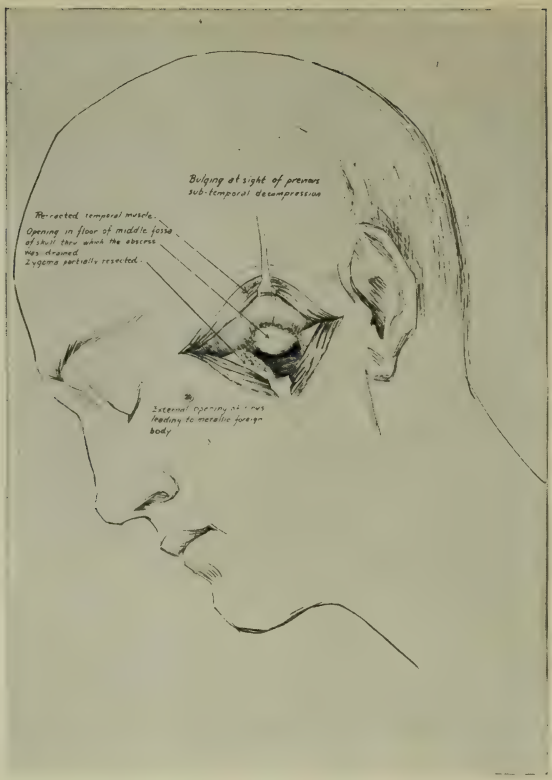
Bulging at sight of previous sub-temporal decompression
Retracted temporal muscle
Opening in floor of middle fossa of skull thru which the abscess was drained
Zygoma partially resected
External opening of canal leading to metallic foreign body

FIG. 6.—Case 2. Diagrammatic sketch, showing resection of zygoma and defect in floor of middle fossa of skull, through which the abscess was drained.

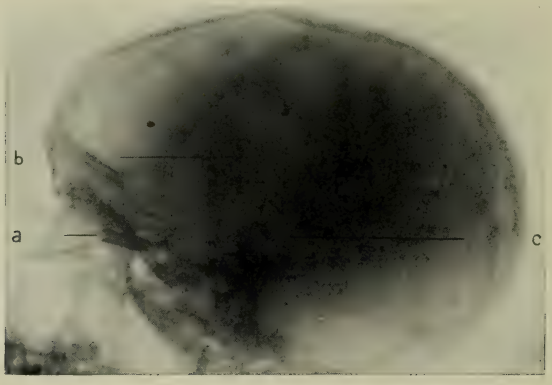

FIG. 7.—Case 2. *A*, rubber drainage tube inserted into the left temporal lobe abscess; note the angle at which the tube extends *B*, center of the skull defect of left subtemporal decompression. *C*, small defect through which the metallic foreign body was removed as shown in Fig. 8.

Localization of the metal was accomplished chiefly through stereoscopic roentgenograms; the fluoroscope, however, was useful in the cases with large pieces of metal.

The operation was carried out in all cases, except Case 1, through a small incision. In Case 1 a unilateral suboccipital scalp flap was turned down, but only a small bony opening made.

The magnet was of less use in these cases than in the handling of cases immediately after injury, since the foreign body in all of our patients was more or less firmly fixed in the brain tissue. This was true not only in those cases in which there was no infection, but also in those in which there was abscess formation. In Case 1 the bullet was plainly visible superficially in the right cerebellar hemisphere; the distal portion could be seen projecting into the abscess cavity and the proximal portion firmly held in the wall of the abscess. In Case 2, in which there was a large abscess in the temporal lobe, the foreign body was not found in the abscess cavity but located at a subsequent operation, firmly encapsulated in the posterior wall of the abscess. After dislodging the body the magnet might have been used for the purpose of dragging it from the brain substance, where it rested at a considerable depth, but this was easily accomplished with a pair of alligator forceps.

Small, folded, rubber tissue drains were always immediately placed in the cavity from which the metal was removed. The metal was always carried directly from the brain to the culture tube and the culture examined daily for several days. If at the end of ninety-six hours there was no growth in the culture the drains were removed; but in the case of a positive culture the original drains were allowed to remain for a period of several months, during which there was always active drainage.

Case 1.—Pvt. P. L. *Right occipital penetration by machine-gun bullet which lodged in the right cerebellar hemisphere; extraction of bullet and drainage of abscess; recovery.*

The patient was wounded September 27, 1918, and admitted to a front line hospital in good condition. There was no attempt made at that time to remove the bullet.

When brought under observation at General Hospital No. 2, Fort McHenry, Maryland, in April, 1919, the roentgen-ray findings (Figs. 1 and 2) were the only clinical evidence of the presence of the bullet. Removal of the missile was advised because of its large size and the fact that the procedure seemed to offer no difficulties.

Operation, May 19, 1919. A unilateral cerebellar exposure was made (Fig. 3). After deflecting the right flap a small portion of bone was removed and a transverse incision made in the dura. There were a few delicate adhesions between the dura and the pia-arachnoid. An exploring needle passed ½ cm. into the hemisphere encountered the bullet. Division of the cortex resulted in a free flow of pus. Further examination revealed a small abscess cavity in the right cerebellar hemisphere which contained about 3 c.c. of pus. Into the abscess cavity the distal two-thirds of the bullet projected while the approximate one-third was firmly encapsulated in the right wall of the abscess. The bullet was removed and immediately placed in culture media, examination of which later showed a growth of Staphylococci. Folded rubber tissue drains were placed in the abscess cavity and brought to the surface at the outer extremity of the transverse incision.

Forty-eight hours after operation there was some headache and elevation of temperature. Drainage continued until November 1, 1919, when there was complete healing. At no time during this period was there evidence of disturbance of the cerebellum.

The case illustrates the course of a septic foreign body with a latent stage, through an attempt at autosterilization terminating in a serious inflammatory lesion. The abscess, which was found during the operation for the removal of the bullet 234 days after the injury, had not been suspected, since the patient presented no neurological disturbance. Had the operation been deferred until the appearance of troublesome symptoms there would have been much greater destruction of the cerebellar tissue and the chances of immediate and ultimate recovery greatly diminished.

Case 2.—Pvt. E. M. *Shell fragment wound left malar region; immediate recovery good; five months after injury there were symptoms of brain abscess; left subtemporal decompression, January, 1919; drainage of temporal lobe abscess, May, 1919; removal of missile in June, 1919; recovery.*

The patient was injured by a bursting shell on August 17, 1918, and remembered nothing concerning his injury until several days afterward, when he found himself in General Hospital No. 9 at Rouen. He then had numbness over the area of distribution of the left fifth cranial nerve and weakness of the muscles of the left side of the face. Eight days after the injury there was improvement in the muscle weakness. September 7, 1918, he was able to walk a few steps, but his memory was poor; there was slight aphasia and diminution of vision, especially of the right eye. There were numerous wounds, all of which healed promptly except the one in the left malar region.

He was admitted to U. S. General Hospital No. 2, Fort McHenry, Maryland, November 27, 1918, when the chief points of the examination were poor vision, especially of the right eye, unpleasant sensations and hypesthesia over the area of the left trigeminal nerve and weakness of the muscles of the left side of the face. Over the left malar region, just below the outer canthus, there was a small scar which marked the site of one of the original wounds. The roentgen-ray photograph showed a metallic foreign body in the posterior inner border of the left middle cranial fossa (Figs. 4 and 5).

About January 15, 1919, the patient complained of severe headache and was somewhat drowsy. January 19 the headache was more severe and the patient was very drowsy. His blood pressure was 110 to 70 mm. Hg. A lumbar puncture revealed fluid under slightly increased pressure, with 155 cells per c.cm., negative bacteriologically. The leukocyte count was 15,000 cells per c.cm. His pulse ranged between 45 and 56, and his highest temperature was 99.2°.

Operation, January 21, 1919. A left subtemporal decompression was done by Major A. R. Calvin and Major B. T.

Stookey. Because of the critical condition of the patient only a short search was made for the foreign body. The operative recovery was tedious.

On January 29, 1919, a small abscess at the site of the original injury in the left malar region was incised. This tract remained open until after complete drainage of the temporal lobe abscess.

Operation, May 23, 1919, drainage of abscess of left temporal lobe. The previous decompression was bulging greatly, so that the abscess could not be entered at this point. After resection of 1½ cm. of the left zygoma (Fig. 6) the point of entrance of the missile, in the floor of the middle fossa of the skull, was exposed. A probe passed through the sinus in the left malar region was used as a guide in locating the opening. The defect was increased by removing the lateral rim, when a dissector was passed into the brain substance and a large amount of pus was evacuated. Only a hurried search was made for the missile, because of the condition of the patient and the fact that the roentgen-ray indicated its position in the posterior inner part of this fossa. After evacuation of the pus a small rubber tube (Fig. 7, *A*) and several drains made of guttapercha were inserted into the cavity. Around these drains the wound was loosely closed.

Following the operation there was gradual return to consciousness, and the immediate recovery was quite satisfactory. Improvement of vision was noticed within a few days.

Operation, June 7, 1919, removal of metallic foreign body from left temporal lobe. An incision about 4 cm. in length was made above and posterior to the left ear. The skull was entered at the extreme posterior part of the middle fossa; the dura was elevated from the posterior wall of the middle fossa to a depth of about 5 cm.; the foreign body was not located. An incision was then made in the dura and the cortex of the temporal lobe elevated to a distance of 5 cm. from the dura, and the metallic foreign body was encountered (Fig. 8). The body was firmly fixed so that a magnet was useless. After dislodging the metal it was seized in alligator forceps and re-

moved. Small, folded, rubber drains were placed to the depth of the tract through which the metal was removed. The operation was completed by loosely closing the wound about them.

In entering the skull at this time great care was taken to work without coming in contact with the bulging cortex at the site of the previous decompression. The bony opening of the skull made for the removal of the body is seen in Fig. 7 at *C*.

The postoperative recovery was entirely satisfactory. There was profuse drainage at the site of the first operation and slight drainage at the site of the second operation for many weeks.

After recovery from the immediate effects of the injury, on August 17, 1918, there was no evidence of increase of intracranial pressure until January, 1919. There were symptoms of neurological disturbance, however, and it is fair to suppose that the lack of symptoms of increased pressure was due to the very gradual enlargement of the abscess. The decompression on January 21, 1919, certainly bridged a critical period, as did the opening of the abscess in the left malar region on January 29, 1919, for the bulging at the site of decompression and drainage in the left malar region continued until the abscess was drained, May, 1919. Just prior to the operation, however, the bulging reached its maximum, and the abscess was too large to be drained through the small sinus.

The method of attack in draining the abscess was somewhat different from that usually adopted, and gave excellent results, because of the low position of drainage and the fact that the abscess was entered at a point where the cortex was adherent to the dura.

Case 3.—Pvt. E. A. *Machine-gun bullet wound in right frontal region; small metallic foreign body and bone fragments in the cortex; small traumatic cyst; operation; removal of metallic and bony foreign body; recovery.*

The patient was injured November 6, 1918, and immediately after the injury was operated on at Mobile Hospital No. 1. His recovery was good.

He was examined at U. S. General Hospital No. 2, Fort McHenry, Maryland, May, 1919. There were two large scars

and a small pulsating area in the right frontal region. Except for headache the neurological condition was normal. Roentgenograms revealed bony foreign bodies (Figs. 9 and 11) well within the cortex and a metallic foreign body (Figs. 9 and 10) just within the bony defect.

Operation, July 12, 1919, removal of metallic foreign body. The bony foreign bodies were not located.

Operation, August 12, 1919, evacuation of traumatic cyst. During the search for the bony foreign bodies a firmly walled cyst, containing about 20 c.c. of clear fluid was encountered. The cyst was evacuated and a search made for the bony foreign bodies, but without success. With a syringe, fluid was aspirated from and air immediately injected into the cyst and a roentgen-ray plate made. In Fig. 11 the outline of the cyst is definitely seen and below its lower portion the distinct shadows of the bony foreign bodies.

Operation, August 27, 1919, removal of multiple bony fragments from right frontal lobe. The cyst was again opened and a small exploring needle passed into its wall at various points. Fragments of bone were located beneath the lower wall, encapsulated in firm tissue. Rubber drains were placed to the depth of the cavity and the operation completed.

Cultures of the fragments were negative for bacterial growth, and there was no drainage at the site of the wounds. The rubber tissue drains were removed a few days after the operation. The operative recovery was satisfactory, but the patient continued to complain of headaches, and there was slight bulging at the site of the defect four months after operation. Repair of the skull defect will be postponed until there is no bulging.

The localization of the bony fragments was greatly facilitated by the injection of air into the cyst, as can be seen in Fig. 11. The cyst cavity was distinctly outlined above the bony fragment shadows, so that it was evident the fragments were to be found in the cerebral tissue well below the inferior border of the cyst.

Case 4.—Sgt. P. J. G. *Gunshot wound in left occipital region; small metallic foreign body in left temporal lobe; operation; removal of metallic foreign body; recovery.*

The patient was injured October 1, 1918. At a forward hospital a large metallic foreign body was removed from the posterior portion of the right hemisphere. For a short time after the injury there was weakness of the right upper and lower extremity, with diminution of sensation.

He was admitted to U. S. General Hospital No. 2, Fort McHenry, Maryland, January 15, 1919. The paralysis had cleared up. There was right homonymous hemianopsia. The roentgen-ray examination showed a small bone defect in the right occipital region, a second small defect in the left temporal region and a metallic foreign body 6 x 4 mm. in the left temporal lobe.

Operation, June 1, 1919, removal of small metallic foreign body, left temporal lobe. An incision 4 cm. in length was made over the left temporal region defect, which was slightly enlarged backward. The dura was opened above the middle meningeal artery, and there were fine adhesions between the dura and the pia-arachnoid. The metallic body was easily located at a depth of 8 mm. in the cortex. The metal was placed in culture immediately after removal. Recovery was prompt, and as there was no bacterial growth in the culture media after ninety-six hours, the drains were removed.

Case 5.—Pvt. R. R. *Gunshot wound in midfrontal region; metallic foreign body deep in the substance of the left frontal lobe; operation; removal of the metallic foreign body and repair of defect of skull; recovery.*

The patient was injured on October 4, 1918; his steel helmet was penetrated and he was immediately rendered unconscious. For a short period there was weakness of the left leg. For several weeks this leg was easily exhausted. His memory was poor.

He was admitted to U. S. General Hospital No. 2, Fort McHenry, Maryland, February 7, 1919. There was a scar 11 cm. extending across the frontal region at the hair-line; be-

neath the scar there was a large bony defect. Memory for recent events was slightly impaired; there was some disorientation for time. The deep reflexes were normal. The roentgen-ray revealed a metallic foreign body ½ x 1 cm. (Figs. 12 and 13) and the large skull defect in the frontal bone (Figs. 12 and 13).

Operation, August 14, 1919, removal of metallic foreign body. An incision 4 cm. in length was made in the left temporal region and a small area of bone removed. The metallic foreign body encountered at a depth of 3 cm. within the cortex was loosely encapsulated and easily removed without bleeding or trauma to the cortex. The metal was immediately placed in culture and small rubber tissue drains placed to the depth of the cavity from which it was removed. Recovery was good. As there was no bacterial growth in the culture the rubber tissue drains were removed on the fourth day. On September 9, 1919, the skull defect was repaired.

Postoperative recovery was good.

The comparatively small size of the missile and the absence of symptoms caused considerable hesitation in attempting its removal. After a delay of several weeks, during which the patient was kept under observation for possible symptoms, he became very impatient and expressed a desire to have the body removed, rather than continue in an uncertain state. Actual removal offered little difficulty, and convalescence was quick because there were no organisms present.

Case 6.—Pvt. V. C. *Fragmented rifle bullet in left frontal lobe; large skull defect; operation, July 14, 1919; removal of two large bullet fragments; second operation, November 26, 1919, drainage of traumatic cyst of left frontal lobe; death January 10, 1920.*

The patient was wounded September 29, 1918, by a rifle bullet; his steel helmet was penetrated and he was unconscious for several days. There were no focal symptoms.

He was admitted to U. S. General Hospital No. 2, Fort McHenry, Maryland, April 2, 1919. The neurological examination was negative, except for headaches and slight mental

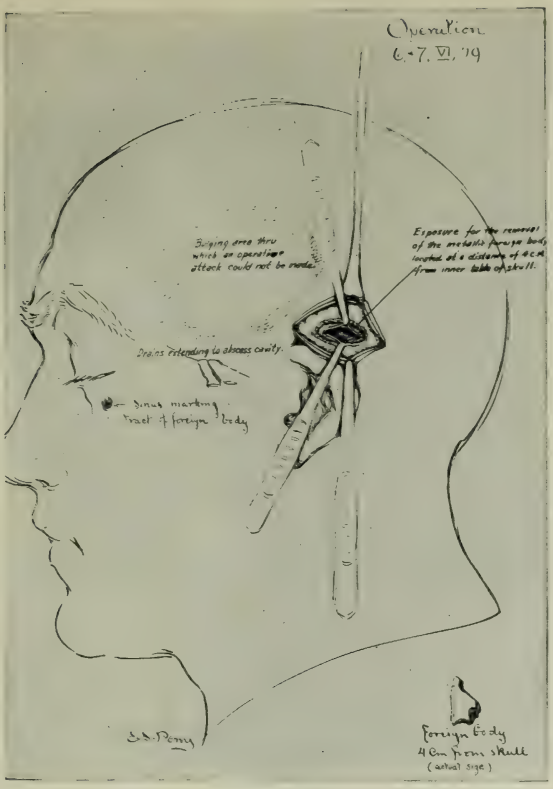
Operation
6-7. VI. '19
Bulging area thru which an operative attack could not be made.
Exposure for the removal of the metallic foreign body, lying at a distance of 4 c.m. from inner table of skull.
Drains Pretending to abscess cavity.
Sinus marking tract of foreign body
Foreign Body
4 Cm from Skull
(actual size)

FIG. 8.—Case 2. Diagrammatic sketch, showing the operative wound through which the shell fragment was removed from a depth of 5 cm. in the left temporal lobe.

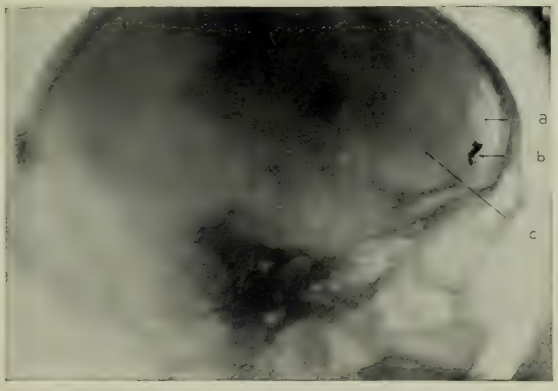

FIG. 9.—Case 3. *A*, small defect of skull in the right frontal region; *B*, shell fragment lying superficially in the right frontal lobe; *C*, bone fragment lying deep in the right frontal lobe.

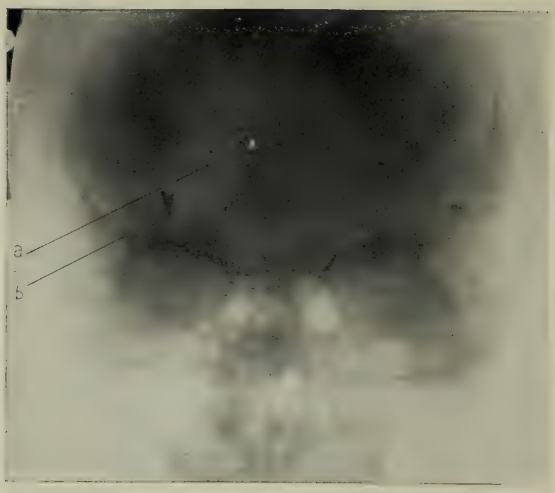

FIG. 10.—Case 3. Anteroposterior view of Fig. 9. The letter indications are the same. The bone fragments cannot be seen in this plate.

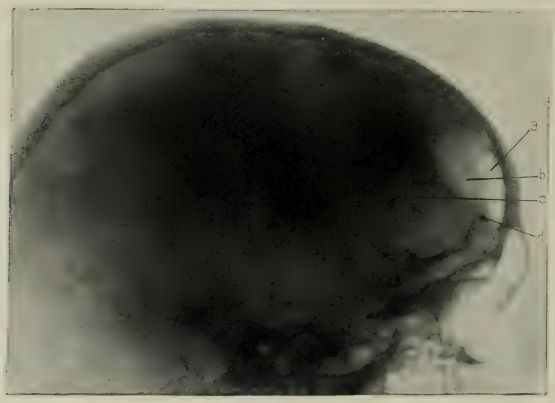

FIG. 11.—Case 3. *A*, skull defect; *B*, traumatic cyst into which air has been injected; *C*, shadow of bone fragments which were removed; *D*, small extracranial foreign body, which no attempt was made to remove.

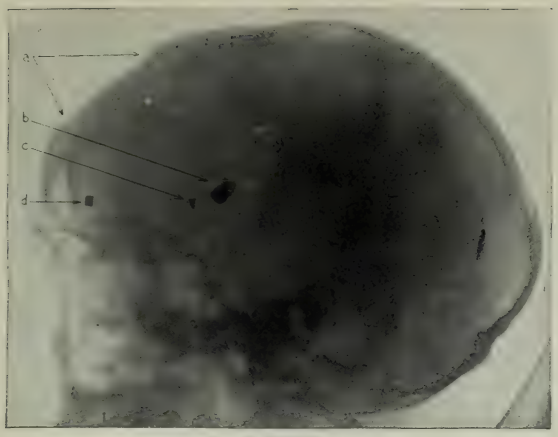

FIG. 12.—Case 5. *A*, skull defect through which the metallic foreign body *B* entered; *C*, a lead marker pasted on the lateral surface of the head; *D*, a similar marker placed over the supraorbital ridge for the purpose of localizing in the stereoscopic plate the metallic foreign body.

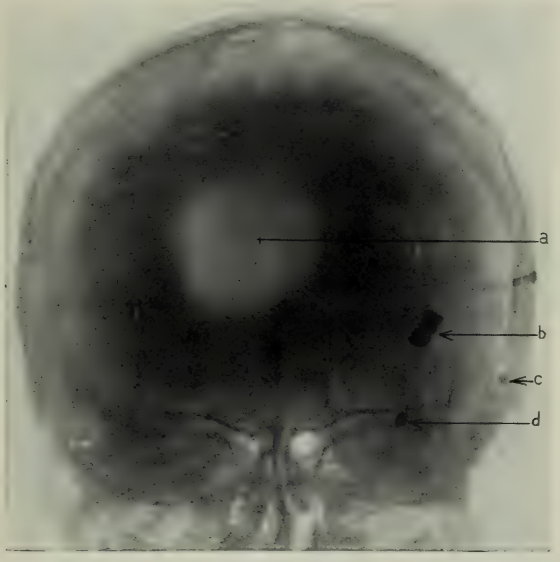

FIG. 13.—Case 5. The anteroposterior view of Fig. 12. The letter indications are the same.

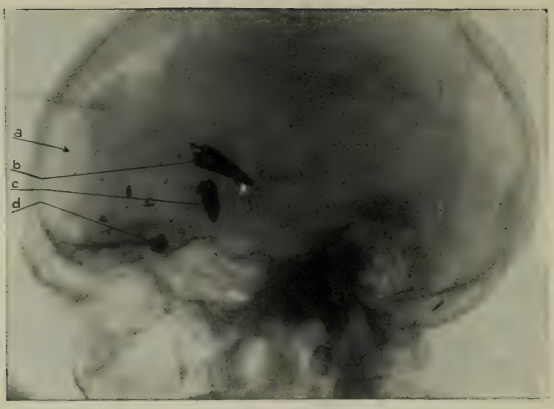

FIG. 14.—Case 6.—*A*, large defect of the skull in the left frontal region; *B*, jacket of the rifle bullet; *C*, the distal portion of steel core of rifle bullet which after removal fitted nearly into the jacket; *D*, proximal portion of steel core. The small metallic foreign body shadows were practically all extracranial and unimportant.

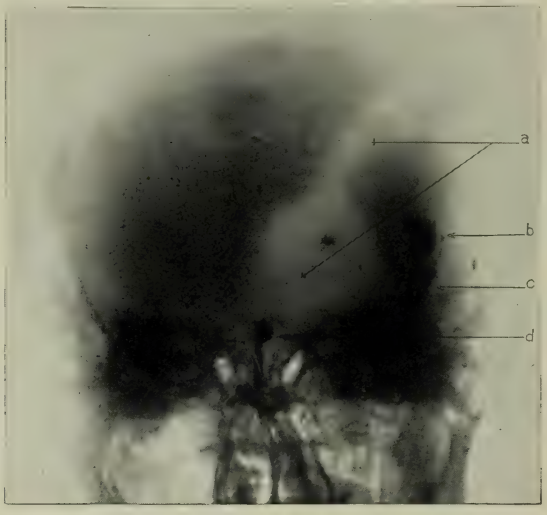

FIG. 15.—Case 6. Anteroposterior picture of Fig. 14. The letter indications are the same. Note the depth of *D*.

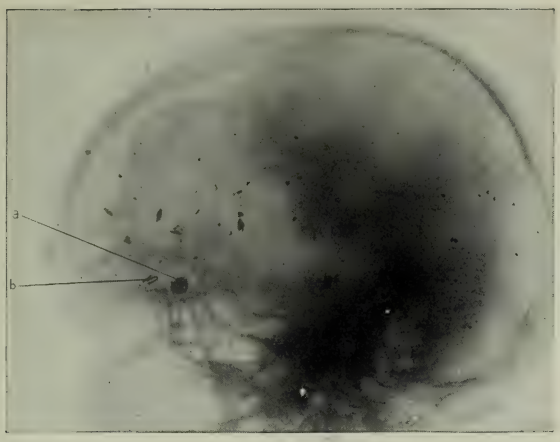

FIG. 16.—Case 6. *A*, proximal portion of steel core of bullet; *B*, silver clips placed as markers on rubber tissue drain. Note the absence of large skull fragments seen in Figs. 14 and 15.

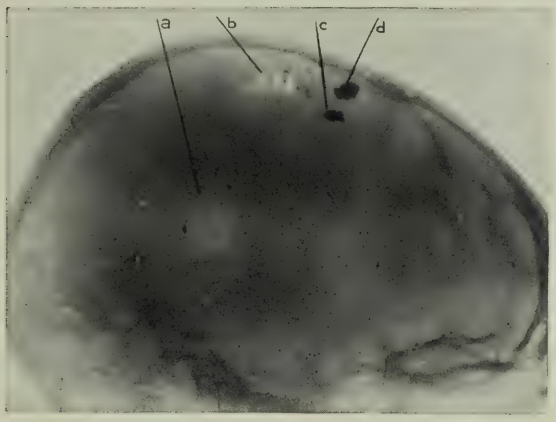

FIG. 17.—Case 7. *A*, small defect in right parietal bone; *B*, small skull defect near the midline, in which there are several small metallic foreign body shadows. *C* and *D*, metallic foreign bodies in the cerebral cortex.

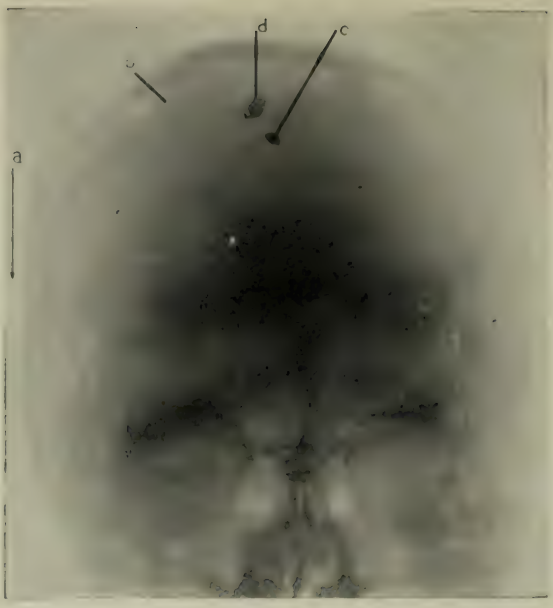

Fig. 18.—Case 7. Anteroposterior view of Fig. 17. The letter indications are the same.

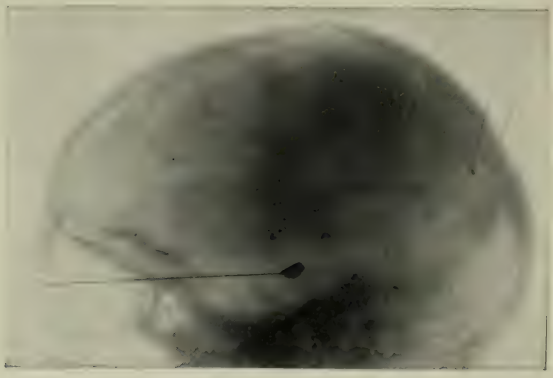

Fig. 19.—Case 8. *A*, shell fragment which there was no attempt to remove because of its depth. In the occipital region there was a small skull defect *C*, which was the point of entrance. Beneath the defect there was an abscess containing bone fragments *B*.

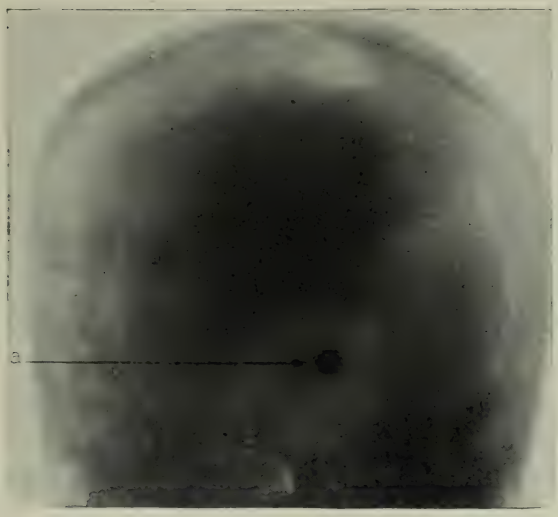

Fig. 20.—Case 8. Anteroposterior view of Fig. 19, showing the metallic foreign body at *A*.

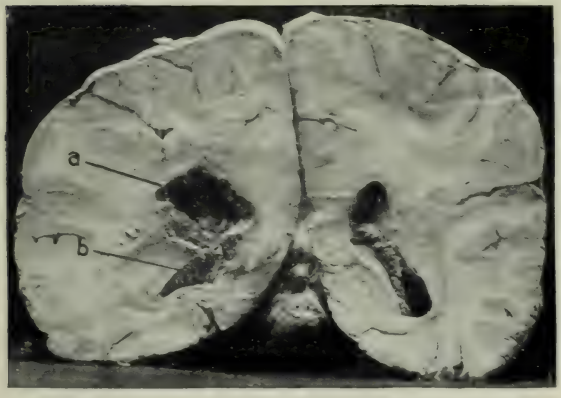

Fig. 21.—Case 8. View of the posterior surface of a transverse section of the brain, showing the abscess at *A* in close proximity to the ventricle *B*.

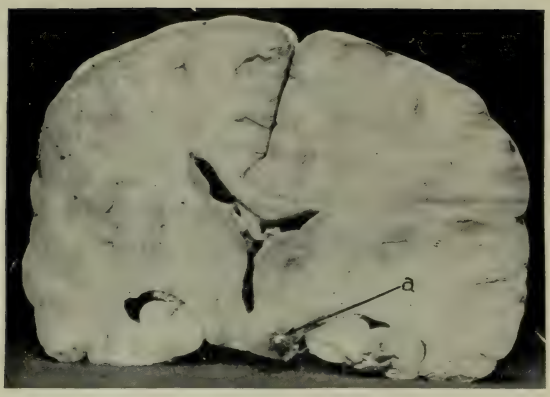

FIG. 22.—Case 8. Anterior view of a transverse section of the brain some distance in front of Fig. 21, showing the metallic foreign body in the left cerebral peduncle. Note the absence of softening or other evidence of irritation.

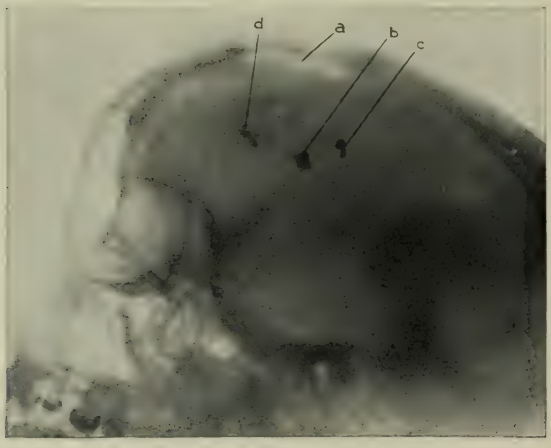

FIG. 23.—Case 9. *A*, skull defect at site of gunshot wound; *B* and *C*, shell fragments deep in the cerebral tissue; *D*, bone fragment shadow deep in the cerebral tissue.

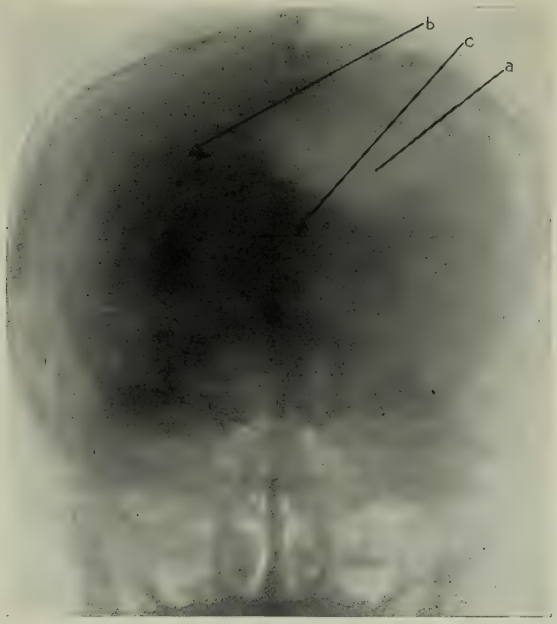

FIG. 24.—Case 9. Anteroposterior view of Fig. 23. The letter indications are the same.

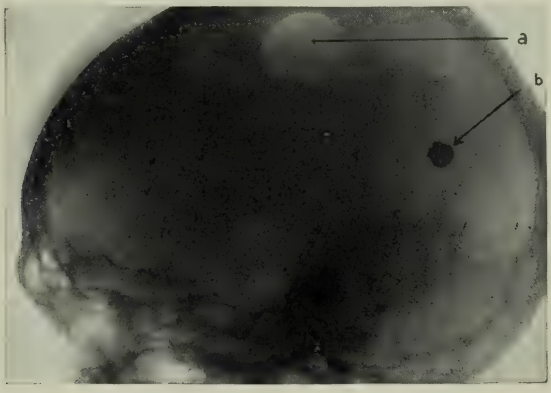

FIG. 25.—Case 10. *A*, small skull defect, the point of entrance of a pistol bullet ten years previous; *B*, thirty-two caliber bullet deep in the substance of the occipital lobe, not causing symptoms.

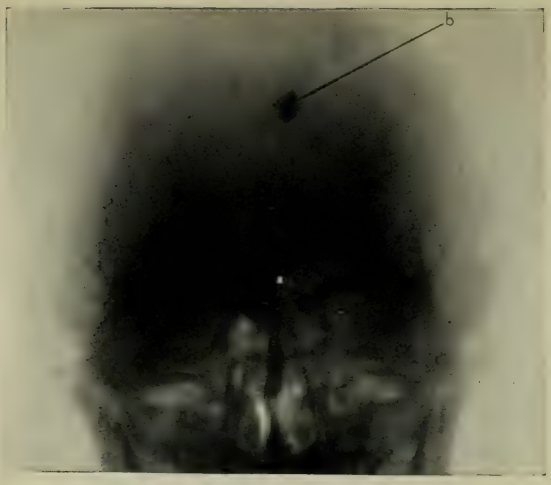

FIG. 26.—Case 10. Anteroposterior view of Fig. 25.

FIG. 27.—*A*, jacket of fragmented bullet removed from Case 6; *B*, distal portion of steel core removed from Case 6; *C* and *D*, shell fragments removed from right parietal lobe of Case 7; *E*, small shell fragment removed from left temporal lobe in Case 4; *F*, machine-gun bullet removed from right cerebellar hemisphere in Case 1; *G*, shell fragment removed from left temporal lobe in Case 2; *H*, shell fragment removed from left frontal lobe in Case 5; *I*, shell fragment removed from right frontal lobe in Case 3.

change. The patient was inclined to treat his condition lightly, was coöperative, but seemed rather irresponsible. There was a large pulsating defect (Figs. 14 and 15). Three shadows indicating metallic foreign bodies were seen in the roentgen-ray plates (Figs. 14 and 15). In addition there were many small foreign bodies, all of which were extracranial.

Operation, first stage, July 10, 1919, exploration for metallic foreign bodies in left frontal lobe. As the bodies were not easily located, silver clip markers were placed on the divided dura and stereoscopic roentgen-ray plates made again.

Operation, second stage, July 14, 1919. Two large metallic foreign bodies to the lateral side of the left temporal lobe were found firmly encapsulated at a depth of 1½ cm. below the surface of the cortex. They were removed with some difficulty, as the surface of the bodies obtained was very rough, and great care was necessary to avoid traumatizing the cortex. Rubber tissue drains were placed to the depth of the cavities from which the bodies were removed and the wound closed. The metal was immediately placed in bouillon culture.

Twenty-four hours after operation Staphylococcus albus was found in the culture, and there was a free drainage of pus at the site of operation. The general condition was good until the ninth day, when, following a period of activity (walking about the ward), there was a series of nine convulsions. These were finally controlled through the use of sedatives. Pus continued to drain for three months, during which time the neurological condition of the patient was practically negative, except for the evidence of mental deterioration as noted above.

Operation, November 26, 1919, drainage of traumatic cyst of left frontal lobe. The left frontal lobe was explored through a 4 cm. incision over the lower portion of the defect in the left frontal bone, and extensive adhesions were encountered between the dura, the cortex and the floor of the anterior fossa. The dissection was carried to within a few millimeters of the foreign body, when there was a free flow of fluid, due to the rupture of a cyst. As communication with the ventricle was suspected and the presence of dormant organisms feared,

small rubber tissue drains were placed to the depth of the wound and the operation terminated; on the rubber tissue drains small silver clip markers were placed.

Immediately after the operation there was a slight rise of temperature and headache and postcerebral rigidity. This condition continued until the fifth day, when there was a gradual clearing up of all troublesome symptoms. There was free drainage of fluid containing Staphylococcus albus at the site of operation. The roentgen-ray plates (Fig. 16) showed the silver clip markers placed on the rubber tissue drains on a plane horizontal with and 8 mm. anterior to the metallic foreign body. Drainage at the site of the frontal exploration ceased January 1, 1920, though the drain was not removed. The general condition was satisfactory; there was no headache and the temperature and pulse were normal. On January 10, 1920, forty-five days after the frontal exploration, the patient, without warning, had a series of convulsions, about twenty in all, and died. The autopsy revealed complete obliteration of the cyst, with yellow gelatinous fluid in the left lateral ventricle.

In this patient the ventricle was evidently penetrated at the time of the injury, since there was a large communication between the cyst and the ventricle at the time of the second operation. After removal at the first operation of the large fragments there was active drainage, but the inflammation was well taken care of by the brain tissue. Drainage of pus was to be expected after the second operation, and it is believed that there would have been no difficulty except for the communication with the ventricle, which made complete drainage impossible. Obliteration of the cyst with distention of the ventricle at autopsy seems to bear out this opinion.

Case 7.—Corporal A. L. *Metallic and bony foreign bodies in right parietal lobe near the midline; left hemiplegia and severe headaches; operation; removal of metallic and bony foreign bodies; improvement of hemiplegia and headaches; recovery.*

The patient was wounded October 22, 1918, by a machine-gun bullet and was unconscious for five days.

He was admitted to U. S. General Hospital No. 2, Fort McHenry, Maryland, April 3, 1919. In the right parietal region there was a large scar extending from the midline to the mastoid region. Beneath the scar there were two small bony defects, one near the midline and the other low in the parietal region (Figs. 17 and 18). At the site of the defect, near the midline, there was a small sinus from which there was a slight amount of pus exuding. In the roentgenogram there were shadows suggesting bony sequestra at the depth of this sinus. Anterior to the opening near the midline were two metallic foreign body shadows (Figs. 17 and 18).

Operation, June 8, 1919, excision of scar in right parietal region and removal of sequestra from right parietal lobe. Under ether anesthesia the entire scar was excised and the sinus at the site of the defect explored to a depth of 1½ cm. Small fragments of bone were encountered and removed. The sequestra were placed in culture media and rubber tissue drains inserted into the depth of the cavity from which the sequestra had been removed.

Forty-eight hours after the operation there was severe twitching of the muscles on the left side of the body without loss of consciousness. This cleared up after the administration of large doses of bromide of potassium. The cultures revealed Staphylococci forty-eight hours after the operation. Following the operation there was some slight improvement of the hemiplegia. The wound continued to drain for several weeks.

Operation, August 29, 1919, removal of metallic foreign bodies from the right parietal lobe. A semicircular incision 6 cm. in length was made in the right parietal region, extending anteriorly from the defect near the midline. This defect was enlarged anteriorly, and, after great difficulty, the small foreign body was located at a depth of 2 cm. below the dura. It was firmly fixed in a capsule. The large body was found ½ cm. below the surface, also firmly encapsulated. Removal of the bodies was accomplished with only slight injury to the cortex, during which there was practically no bleeding. The metal was immediately placed in culture media and drains inserted to the depth of the cavities.

Recovery was prompt. There was no growth in the cultures during ninety-six hours. The drains were removed on the fourth day. The headaches were improved, but were still more or less troublesome. There was slight improvement in the left hemiplegia, due in large part, no doubt, to physiotherapy.

Case 8.—Sgt. D. F. *Gunshot wound of left occipital region; abscess of left occipital lobe; metallic foreign body in left cerebral peduncle; operation; drainage of abscess; death due to septicemia.*

The patient was wounded July 4, 1918. There was immediate, complete right hemiplegia. The patient did not lose consciousness. He was taken prisoner by the Germans, and while in a German hospital a piece of shrapnel was removed from the left occipital lobe. The arm and leg gradually improved, and in November, 1918, the patient began to walk.

He was admitted to U. S. General Hospital No. 2, Fort McHenry, Maryland, March 24, 1919. There was spasticity of the right upper and lower extremities. The patient was able to walk without assistance. His handwriting was poor, very coarse and irregular. There were occasional headaches. At the site of the wound in the occipital region there was a small sinus from which yellow pus exuded. The roentgen-ray examination revealed a bone defect in the left occipital region. Beneath the defect there were several shadows, indicating bony sequestra deep in the brain substance, and a metallic foreign body (Figs. 19 and 20), just to the left of the midline in the anteroposterior plate, and about 2 cm. above the shadow of the external auditory meatus in the lateral plate. Because of suppuration in the left occipital lobe, removal of the bony sequestra was recommended, while the depth of the metallic foreign body contraindicated any attempt at removal.

Operation, June 5, 1919, removal of sequestra. Under ether anesthesia a small incision was made at the site of the sinus in the left occipital region. Several small sequestra were removed from a depth of about 2 cm. During this removal it was noted that the sequestra seemed to be lying loosely in the tissue. The fragments were immediately placed in culture media and small rubber tissue drains inserted into the cavity.

Forty-eight hours after operation the cultures showed a growth of Streptococcus hemolyticus; headaches gradually increased and for several days there was stupor with slowing of the pulse and choked discs.

Operation, June 22, 1919, drainage of abscess of left occipital lobe. A small opening was made anterior to the defect. An exploring needle was introduced into the occipital lobe and about 30 c.c. of greenish pus evacuated. Rubber tissue drains were placed in the cavity.

Twenty-four hours after operation there was a sharp rise of temperature to 105° and increased pulse-rate of 180. Within a few hours there was a rapid decline of temperature. The following day there was another sharp rise of temperature while the pulse-rate remained rapid. The patient did not present the appearance of one suffering with meningitis, nor were the symptoms of increased intracranial pressure prominent; the clinical picture resembled septicemia. Death occurred on June 25, 1919.

The autopsy revealed a large abscess in the left occipital lobe communicating with the ventricle and a metallic foreign body firmly encapsulated in the left cerebral peduncle entirely removed from the abscess cavity (Figs. 21 and 22). The endocardium was the seat of recent inflammatory changes, and cultures from it showed Streptococcus hemolyticus. Cultures from other organs also showed the same growth.

The condition of the patient before the first operation, June 5, 1919, indicated the presence of an abscess in the left occipital lobe, which was causing moderate disturbance. The operative manipulation is believed to have excited the dormant Streptococcus hemolyticus, resulting in an increase in the size of the abscess, general septicemia and death.

This case should, perhaps, have been classified with the inflammatory cases, of which we hope to write later, since there was no attempt made to remove the metal. It is included, however, with this group since it so well illustrates the relative seriousness of bony and metallic foreign bodies in the brain. The postoperative course was certainly unusual in that the

symptoms suddenly changed from those of increased intracranial pressure, with subnormal temperature and pulse-rate to high temperature and very rapid pulse. The condition was not well understood until the autopsy, when blood cultures from various organs, including the heart, gave Streptococcus growth.

Case 9.—Pvt. R. H. S. *Gunshot wound in left frontal region; metallic foreign body deep in the left frontal lobe; no symptoms; no operation; recovery.*

The patient was injured November 9, 1918, by a bursting shell. Several pieces of metal and bone were removed at one of the forward hospitals.

When he was examined at U. S. General Hospital No. 2, Fort McHenry, Maryland, there were no neurological symptoms, and the general condition of the patient was good. Roentgenograms revealed a bony defect in the left frontal region and two metallic foreign bodies (Figs. 23 and 24). The defect in the left frontal region was the seat of marked pulsations, which caused the patient to desire that the foreign bodies be removed and the skull repaired.

Because of the absence of serious symptoms and the fact that the bodies were not large, but deeply placed in the brain substance, their removal was not attempted. The patient was discharged from the army, with instructions to report later.

Case 10.—Civilian J. L. *Pistol bullet in left hemisphere for ten years; no symptoms; no operation.*

In 1909 the patient was injured by a thirty-two caliber pistol bullet. Immediately following the injury there was only slight neurological disturbance and it was decided not to remove the missile. Since the injury the patient has suffered no ill effects, but presented himself for examination with the intention of leaving the bullet undisturbed if it were advisable. A roentgenogram revealed a small skull defect (Fig. 25) and the bullet shadow (Figs. 25 and 26). This case again illustrates the fact that metallic foreign bodies in the absence of infection are well tolerated in the brain tissue.

The postoperative roentgen-rays for these cases have not been included, but the foreign bodies removed may be seen in Fig. 27.

SUMMARY. The end-results of the cases may be summed up as follows:

Case 1. Complete recovery.

Case 2. Complete recovery with the exception of dim vision of the right eye, due to direct injury at the time of the accident.

Case 3. Persistence of headache, which has made it necessary to defer repairing the skull defect.

Case 4. Complete recovery.

Case 5. Complete recovery, with repair of the skull defect.

Case 6. Death, the result of infection due to the disturbance of dormant organisms in the scar tissue surrounding a cyst in the frontal lobe, which communicated with the ventricle.

Case 7. Recovery, with marked degree of hemiplegia of the opposite side, which is gradually improving.

Case 8. Death, the result of Streptococcus hemolyticus septicemia, which was due to the stirring up of dormant organisms in the left occipital lobe.

Case 9. No operation, because of the inaccessibility of the metal and the absence of symptoms; discharged from the army in good condition.

Case 10. No operation, since there were no symptoms after a period of ten years.

This report has been made possible through the coöperation of the various departments of the U. S. General Hospital No. 2, Fort McHenry, Maryland, and through the personal assistance of Lieutenant-Colonel T. J. Leary, the chief of the surgical service, Major J. F. Lutz, in charge of the roentgen-ray department, and Lieutenant M. J. Egan, assistant in the neurosurgical service.

THE LATE TREATMENT OF GUN-SHOT WOUNDS OF THE HEAD

By H. H. Kerr, M.D.
Washington, D. C.

Of the vast amount of good that war surgery can contribute to civil surgery there is perhaps nothing more striking than the results obtained in the treatment of head injuries complicated with paralysis. The cases with wounds of the skull involving the brain present two types of disability: One from the skull defect *per se,* and the other from injury of the underlying tissue. The treatment of these cases will therefore be considered under two distinct heads, surgical and neurological.

Surgery can repair only the mechanical defect and its immediate results. All of the cases present to a greater or less degree the "defect syndrome." They are morose, retiring and avoid their fellows. They suffer more or less from headache. Stooping over or turning suddenly will produce dizziness. Loud noises are extremely irritating. Exposure to the sun produces headache and prostration. Perhaps the fear of injury and knowledge of incomplete protection to their brains contribute to this characteristic train of symptoms. There is a definite disability from skull defect, that is absolutely independent of any accompanying neurological lesions.

The defect syndrome can be improved or cured by the correction of the cranial defect. Various types of operations have been suggested, from the use of metal or other plates to osteoplastics of one kind or another. In the neurosurgical section at the Walter Reed General Hospital we adopted the osteo-

FIG. 1.—Large cranial defect with spastic hemiplegia, repaired with osteoperiosteal graft taken from opposite side of head. Graft solid in four months.

FIG. 2.—Defect of frontal bone with extreme depression, repaired with osteoperiosteal graft taken from tibia.

FIG. 3.—Frontal defect repaired with osteoperiosteal graft.

FIG. 4.—Operation, first step. Subglial injection of 1 per cent. novocaine.

FIG. 5.—Operation, second step. Exposure of bone defect and freshening edges with chisel.

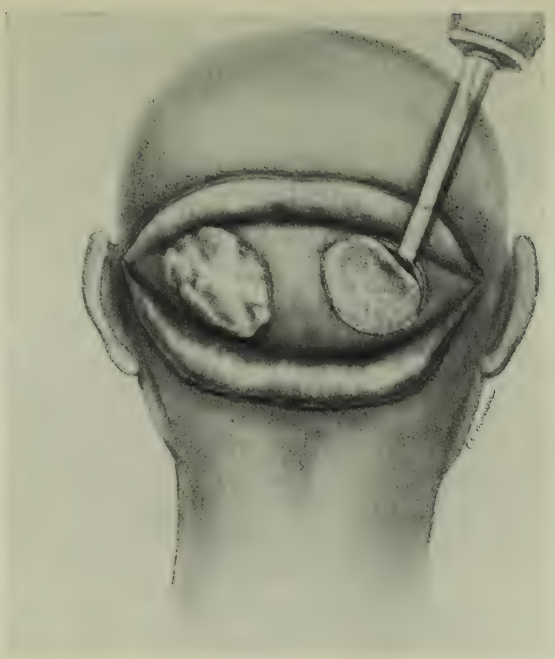

FIG. 6.—Operation, third step. Linen pattern of defect cut and laid on neighboring pericranium as a guide to chiseling off osteoperiosteal graft.

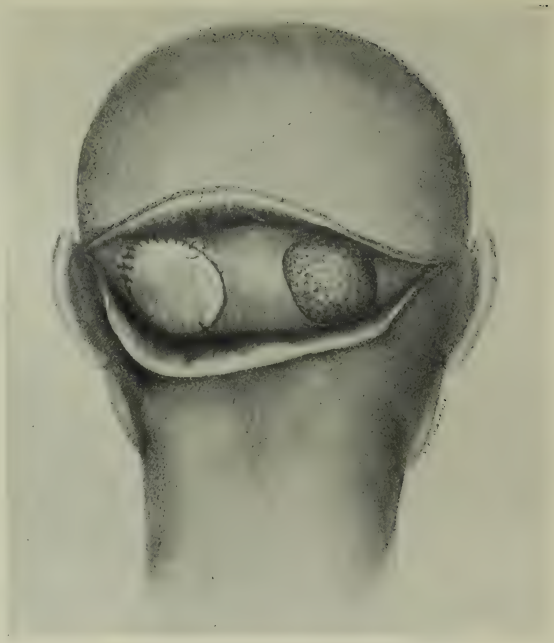

FIG. 7.—Operation, fourth step. Graft being sutured over defect bone surface inward.

FIG. 8.—Operation, fifth step. Closure of wound with 24-hour drainage.

periosteal graft of Delangier. We have modified it in two particulars: (*a*) First, we prefer operation under local anesthesia in the head-high position. This materially reduces

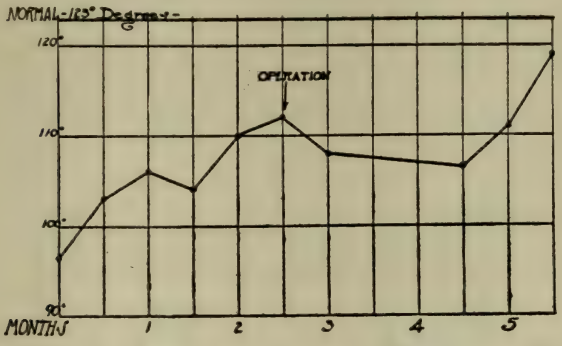

CHART 1.—C. L. Gunshot wound of head. Hemiplegia. Chart shows dorsiflexion of left ankle.

hemorrhage and lessens the bulge of the accompanying cerebral hernia. The patients stand the chiselling, not only of the defect, but the cutting of the graft, remarkably well. (*b*) We have also changed the original technic in that we sew the graft

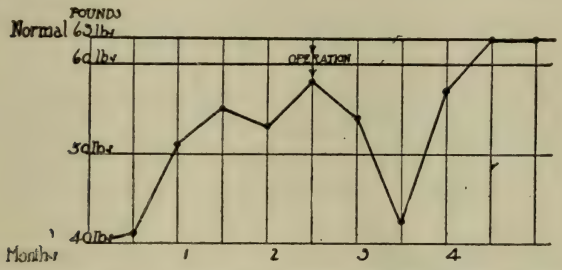

CHART 2.—DeM., J. Gunshot wound of the head. Hemiplegia. Showing strength of right anterior deltoid.

to the pericranium with the bone surface inward. In this way we feel that the requirements of successful bone-grafting are best obtained, *i. e.* a fresh autoplastic graft fixed in place with

the bone of the graft in contact with living bone. The operation should be delayed for at least three months after healing. In cases with osteomyelitis of the skull it is better to delay the bone graft to at least six months after healing of the wound. The results have been eminently successful. No graft had failed to live and only one has not become solid within four months. In that case osteogenesis appears to be progressing from the periphery, and a successful, though depressed correction is expected.

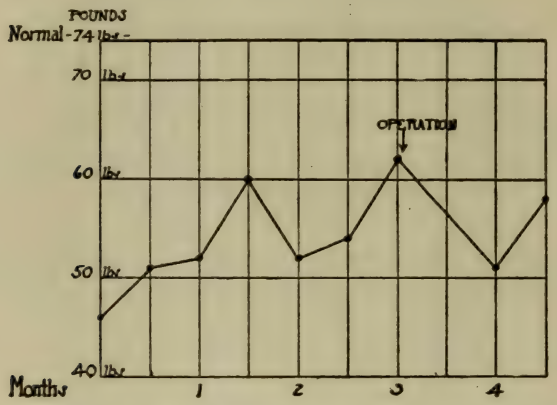

CHART 3.—Same case as in Chart 1, showing flexion of right elbow.

The effect on the patients is most encouraging. They become bright, active men, who resume their normal places among their fellow-soldiers and attack the problems of reëducation with a hopeful vigor. Their dizziness is relieved. The headache disappears in the majority of cases. The graft protects them from the irritation and loud noises and the heat of the sun. Although the question as to whether a skull defect should be repaired or not may still be debated, we feel from our personal experience that it is settled in favor of the repair.

As to the treatment of the neurological complications of gunshot wounds of the head we have followed the works of Dr. Shepherd Ivory Franz, scientific director, Government Hos-

pital for the Insane. Dr. Franz has kindly visited our clinic and given us the benefit of his personal advice on many occasions.

The first requirement of these cases is a thorough study by a competent neurologist. On the basis of his diagnosis the treatment is prescribed. In the cases of gross spastic paralysis

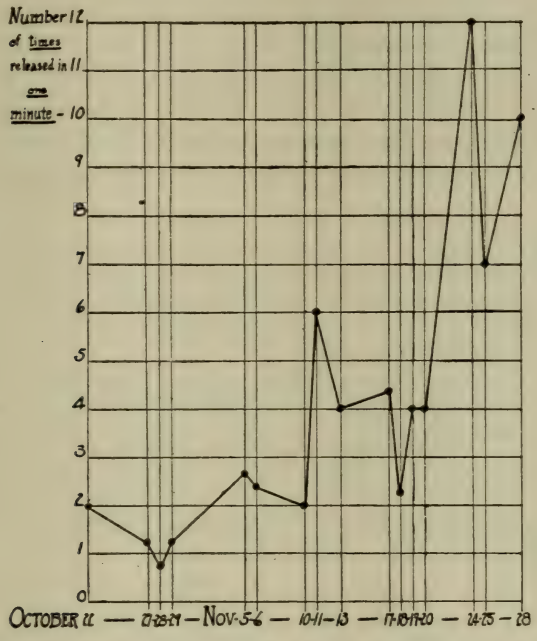

CHART 4.—R., J. Gunshot wound of head. Hemiplegia. Chart shows the number of times ball was released in one minute.

daily massage and splinting are instituted at first. The masseuse is instructed to gradually stretch each contracted muscle. The overstretched extensors are treated by massage and deep transverse percussion. The massage is accomplished by passive exercises, with special attention to extension to overcome the continued flexion. Splints which overcorrect the contractions may be worn intermittently. The massage and passive exercises

are employed to make possible the voluntary use of the extensors in simple movement. In certain cases voluntary movement could not be obtained for some weeks, but in all cases they were eventually brought out. At a very early date the patients are gotten out of bed and urged to walk. During this early period a right-angle stop splint has to be worn on the ankles to permit locomotion. Crutches and later canes are necessary, but their use is soon discouraged and the patient made to walk by himself, no matter how awkwardly or slowly he does it.

Under such a regimé the bed-ridden paralytics were soon up and around the wards. The cases were then given reëducative exercises of a competitive nature or in game form. Each movement must be considered in the light of its three components—

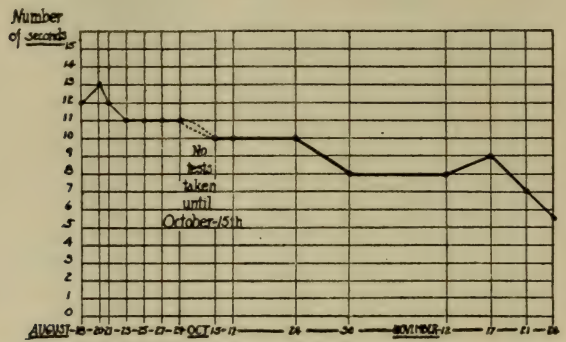

CHART 5.—Same case as in Chart 4. Showing number of seconds consumed in running 20 meters.

its extent, its force and its time. The exercises aim to produce first extent of motion, later force and finally rapidity. When all three have been brought to normal, an accurate motion has been produced. Stepping over a string standard, kicking a basket-ball at a target, dropping a tennis ball into a basket are types of the exercises employed.

The game idea and the sense of competition is made an integral part of the reëducation. To this end scores are kept of the different exercises and games in which the patients take

part. For instance, a man's ability to stretch his arm up the wall, or to release a tennis ball into a basket a certain number of times in a given time, is measured from day to day and compared to like efforts of his fellow-patients. A game of baseball is played every day by all the patients together. It is most interesting to watch one of these games. No matter how awkward a motion may be performed, under the stimulus of the game they somehow seem to be able to make hits and score runs, apparently forgetting their disability in the effort.

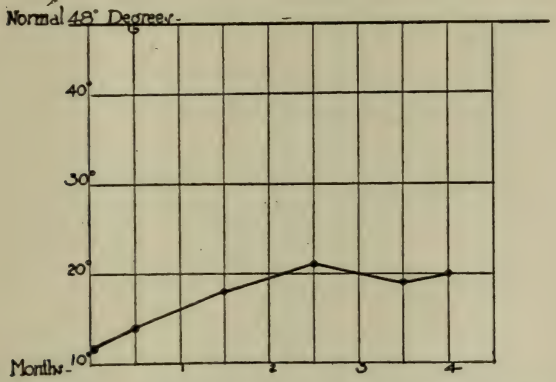

CHART 6.—Same case as in Charts 4 and 5. Chart shows flexion of right knee.

In addition to the scores of their exercises each patient is measured as to his extent, strength and speed of movement at least once a fortnight. The results of these measurements are charted graphically and tacked to the wall, where each patient may not only see his own progress but the progress of his fellow-patients. In addition to the moral stimulus that these charts give the patient himself, they are an invaluable guide to the therapy. Thus particular attention is paid to that movement which shows the least improvement. In this way one group of muscles is brought back toward normal as soon as another and substitution of movement does not occur. As im-

provement progresses exercises which educate the time and the accuracy of each movement are instituted. When the patient can grasp a pencil he is made to practise drawing a circle, then a square and thus gradually is taught to write again.

Cases with gross defects and destruction of the motor cortex gradually acquire all the movements which they had lost. As Dr. Franz says, "We must therefore look on the different forms of cerebral paralysis as exaggerated difficulties of movement

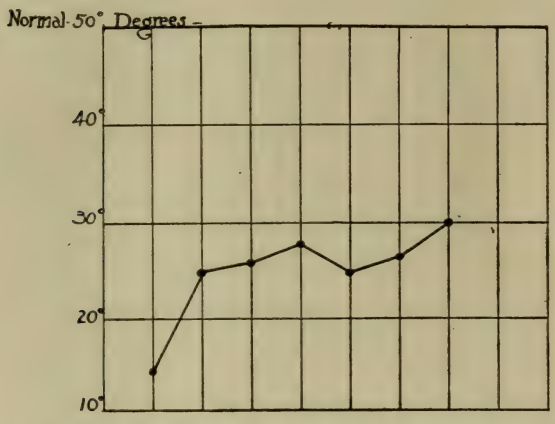

CHART 7.—Same case as in Charts 4, 5, and 6, showing flexion of right elbow.

and not as inabilities to move. The facts show that the loss of certain function because of cerebral destruction does not indicate that the individual has not the function of capacity if suitable conditions of stimulation are provided." An experience with a large number of cases of cerebral paralysis most strikingly demonstrates that much more can be done for these cases than is commonly supposed. With proper appreciation of this fact we should be able to reëducate each case of traumatic cortical injury to a degree of practically no permanent disability.

DISCUSSION ON THE PAPERS OF DRS. BAGLEY AND KERR

Dr. John Wesley Long, Greensboro, North Carolina.—Apropos of the splendid paper by Dr. Bagley, I would like to show two cases of retained missiles in the brain both of which occurred in civilian practice. I have a few slides brought back from France, but as we are all civilian practitioners now, I will only show those. The first patient is a man, thirty years of age, who was shot in the left parietal region, the bullet going through the brain. I saw this man on the eighth day. He was comatose, was having frequent convulsions and was absolutely paralyzed in his left leg. The next slide gives us an anteroposterior view of the same case. I operated on this man at once, trephining, removing a number of pieces of bone and draining the wound of entrance. I did not attempt to remove the bullet. The man's convulsions ceased at once and he gradually and completely recovered from his paralysis. The next case is a boy, five years of age, who was shot just above the left eyebrow. You will see that the bullet lodged in the posterior fossa of the skull. The next slide shows an anteroposterior view of the same case. The bullet is near the median line. This boy was desperately ill, greatly shocked, and came near dying while the pictures were being taken. When he was put back to bed he recovered rapidly. No operation was done, and he has had no untoward symptoms. Here is the slide of another boy who was shot in the forehead in the median line. You will see a number of spicules of bone over to the right. You can see the position of the bullet. This boy was paralyzed in the left leg and left arm and profoundly shocked. The next slide shows an anteroposterior view of the same case. You can see by both views the location of the bullet. After a few hours to overcome the shock I operated upon him, removing quite a portion of bone where it was comminuted including a part of the groove for the longitudinal sinus. The next day the paralysis of the arm was better and soon disappeared entirely. The second day the paralysis of the leg was better and soon disappeared. The third boy was shot through the forehead. I show you a radiogram taken laterally and one taken anteroposteriorally. The bullet, as

you have observed, is almost in the center of the brain. The accident occurred in 1914. Three years later I took similar radiograms. I then took a composite picture of the *x*-ray plates placing the 1917 plate over the 1914 plate. The slide of the composite plates shows the bullet *in situ* after three years. The boy had no symptoms at the time nor has he had any since, now five years.

Dr. C. C. Coleman, Richmond, Virginia.—I want to speak for a few minutes on the repair of cranial defects, which was discussed by Dr. Kerr and referred to by Dr. Bagley in his paper on retained missiles.

We found at Cape May that about 25 per cent. of head injuries required repair of cranial defects for the relief of the "trephine syndrome" which was quite definitely established in many of these cases. In 208 head cases there were 52 cranioplasties. The anesthesia usually employed in the service of Dr. Frazier, Dr. King, and myself was ether, and there seems to be an advantage in using ether if the patient's condition is good. Under ether anesthesia there is protrusion of the brain through the defect, due to the rise of intracranial tension, and by applying a thin bone graft you get exactly the same contour of the skull over the defect, which is so essential from the cosmetic standpoint. I think it has been shown that osteogenesis resides just below the periosteum and that it is not essential in the repair of cranial defects to have thick grafts. On the contrary, there is a distinct advantage in using a thin graft. After the patient has been returned to bed and put in the horizontal position the slight protrusion of the cranial contents which the horizontal position favors, will keep the thin graft molded into the proper curve until the graft fragments become fixed. The postoperative head-elevated position is likely to be followed by some depression of the graft due to the falling away of the brain from the defect, and this depression will be permanent. It was the rule in the later cases to put the patient in the horizontal position for two weeks, thus allowing the intracranial contents to support the bone graft and give it the proper contour. By adopting this method there was great improvement in the cosmetic appearance of the grafted area. Autogenous cranial transplants were used in practically all cases, although the transplant may be

removed from the tibia. The use of tibial transplants, however, should, theoretically at least, exhibit a greater tendency to callus formation, which might be shown by exostosis and cortical irritation.

Extensive scars of the scalp should be excised at a preliminary plastic operation before attempting a repair of the defect. In these cases in order to get the best results it is necessary that the bone transplant should be covered with skin which is not under excessive tension. In the Cape May cases the bone transplant was usually removed from the region of the parietal eminence. The necessary chiseling therefor was done over the thickened portion of the skull and posterior to the motor area. There were no deaths in the cranioplasty series at Cape May, and no undesirable results followed the removal of the transplant from the cranium.

Dr. F. G. DuBose, Selma, Alabama.—There is just one feature that has not been brought out. The use of ribs in closing skull defects. It is worth while in civil practice. About six months ago, we had a man brought in who was practically insane from the trephine syndrome. Seven years previously, he had an area of destruction of bone of three and a half or three inches over the frontoparietal region. He was morose and apathetic, and his family were considering committing him to an insane hospital.

At the first operation a large flap, such as is done in a decompression operation, was turned back and the dura opened to see if any adhesions were present. After dividing adhesions, we sutured the dura and the flap. A month or six weeks afterward the flap was turned back a second time; and three and a half inches of one of his ribs resected, that portion of the rib which was curved to conform to the cranial curve being used. Unfortunately, in taking the rib out in its entirety we opened the pleura; this was closed by suture, and no disturbance followed this or the anesthetic. Shock was absent. We simply made a mortise in four places of the rim of skull, surrounding the defect, for the rib to fit in; and with a saw split the rib in halves. We found the curve of the rib exactly conformed to the curve of the skull; drilled a hole through each mortised and tendon joint to securely hold the ends of rib to the skull with

sutures of kangaroo tendon; pulled the flap back and sutured it in place. A perfect clinical result was obtained. In looking at the skull, it has the same conformation on both sides, with a slight indentation between the two ribs. We turned the split edges of the rib toward each other. In two weeks this man was out of the hospital.

Dr. Alexander Primrose, Toronto, Ontario (by invitation). —I rise not so much to discuss the papers we have heard, but to take this opportunity of thanking the Association for the courtesy extended to me in the privilege of attending this meeting. The subjects which are under discussion are ones in which I am personally very much interested because we have had quite an extensive experience in connection with foreign bodies in the skull and cranial defects, both overseas and more recently in the cases which returned home.

I was very much pleased to note the conservative tendency of the papers which were read. We should exercise great care and conservatism in recording our experiences and in drawing conclusions therefrom, if these are to be of any great value in the future in suggesting the method of dealing with such conditions. I refer to that because those of us who have been following the literature will agree that a great deal of faulty work—I was going to say careless work—has been done in recording cases and the impressions one gains from many of the papers written are erroneous in many respects. The opinion has been expressed here advocating the conservative treatment of foreign bodies in the brain. I might narrate the history of one particular case which is instructive. A man returned from France to Canada, with a history that a bullet entered the right side of the cranium and lodged about 3 cm. below the dura mater on the left side of the skull in the anterior parietal region. When I came home from overseas I was asked to see this man in consultation with the view of determining whether he should be operated upon or not. He was extremely keen to have an operation. In going into the case I found that his symptoms were almost entirely interpreted by the damage to the brain tissue along the track of the bullet, and we could find nothing to make us believe that the bullet lying beneath the cortex was doing any damage there. Among other methods of investigation we

had a careful stereoscopic *x*-ray picture taken and we found no visible evidence of pathological change in the tissues about the bullet. He was not under my observation very long. He happened to come in contact with a nurse in Toronto who had graduated from Johns Hopkins Hospital, and who had the very greatest and highest appreciation of Dr. Harvey Cushing—an opinion which we all share because of his brilliant work. It was suggested that he go to Dr. Cushing. There was a great deal of difficulty and red tape in connection with sending him across the border for treatment as it did not appeal to the Military Authorities in charge of the case in Canada. However, permission was eventually obtained and he proceeded to Boston. Dr. Cushing did not know that I had seen the man and gave an entirely independent opinion of his case. He determined that this man should not be operated on and sent him back to Canada, with the suggestion that if he were removed from sympathetic friends, he might make a more rapid recovery. Subsequently the man went out West, was sent from the hospital in the West to another Clinic on the Atlantic Seaboard and there (I do not know who saw him) he was operated on and the bullet removed. I was subsequently spoken to regarding this case by a senior member of that particular staff who thought it was rather a good joke that this man should have a bullet removed from the brain in —— hospital, which in Boston and Toronto they were afraid to tackle! It was of course an easy surgical procedure to remove the bullet but it involved serious damage to the cerebral cortex.

I think that neurologists are with me in the view that the more carefully and more conservatively we deal with the cortex of the brain, no matter where the bullet is, the better, and I think it is absolutely unjustifiable to go after a foreign body through a normal cortex if it is doing no harm by its presence. In this case we would have had to traverse the uninjured cortical substance because the bullet came from the other side.

I might speak of another case of a man who had a bullet enter the top of the head and which lodged in front of the olivary eminence of the sphenoid bone and the optic commissure. This man, after some six months, developed meningitis, indicating the fact that these bullets sometimes do give rise to late trouble. The cerebrospinal fluid contained pus. He was at Camp Borden.

My assistant (Major George Wilson) saw him and found him in a desperate condition. He realized that the only thing to do was to tackle it. He enlarged the opening in the vertex of the skull. He had considerable difficulty with bleeding from the superior longitudinal sinus and the superficial cerebral vessels. However he carefully separated the cerebral hemispheres and following alongside the falx cerebri was able to reach the bullet by forceps and remove it. The man made a complete recovery. Such a result is an encouragement to us to interfere, even in apparently hopeless cases, where the indications for operation are clear.

Lastly, I would like to refer to a method of grafting the skull which I reported to the American Surgical Association last June. It was a case in which I removed a very large piece of parietal bone from a cadaver about the size of the palm of one's hand, and used this as a transplant to close a very large cranial defect. I reported that case six months after operation and I mention it now because it brings up some important points regarding the fate of the bone graft which we have not yet solved. At the time I reported it *x*-ray pictures showed that some of the numerous holes, which had been drilled in the graft were disappearing and apparently in certain areas condensation and thickening were in progress. Subsequently a large part of the bone softened while about the edges there was a gradual increase of density. It is now some twelve months since the grafting was done and I am still in hopes we may get the defect to close. We have been taking numerous skiagrams from week to week, and we are following the case with interest. It will be instructive to see what subsequently becomes of it.

Dr. William Perrin Nicolson, Atlanta, Georgia.—Fifteen years ago, at the Birmingham meeting of this Association, I reported a number of cases where I had covered openings in the skull with celluloid plates. Since that time I have in the neighborhood of one hundred people wearing these plates, absolutely free from any irritation. I have removed one at the end of fifteen years on account of another trouble in the brain, the tissue having been entangled about it. It remained there without irritation, and in looking at the man's forehead it was impossible to tell which side it was on. At the time I proposed it,

I drilled the skull, make a plate, and put it in with silver wire and twisted it so as to hold the plate in place. After being caught where I had no silver wire, about six years ago I simply nailed the plate to the skull with carpet tacks. Since that time, as a routine, I drill fine openings with a drill and anchor these plates with ordinary carpet tacks. The plate can be put in at once and shaped with the curve of the skull with boiling water brought to the operating table. There is no danger of sinking in with atmospheric pressure, and it remains from the beginning without irritation whatever. It does not require any dangerous operation, as in the case reported by Dr. DuBose. Anybody who can drill a hole and drive a tack can put in a piece of celluloid, and it does not require more than five minutes to do it. Two men served through the war with these plates in their heads. I do not know of anything that fills the requirements so completely as this plate; it does not take very much time, and it requires no particular skill to put it in. Any man who does bone grafting requires special skill, but these plates can be put in safely with very little skill. In a number of cases I have taken out the plates eight years or more later on account of the formation of a cyst or cysts. In the case in which the plate remained over fifteen years, it produced no irritation whatever and became incorporated in the tissues of the scalp.

Dr. Alexius McGlannan, Baltimore, Maryland.—I desire to mention two cases which illustrate the advantage of conservative treatment in gunshot wounds of the head. These were patients who came to us six and eight years ago respectively. Both were boys ten or twelve years of age, who had been shot with a low caliber rifle in the right temporal region and showed signs of compression and intracranial hemorrhage. The *x*-ray showed the bullet in the left posterior fossa of the skull. No attempt was made to remove these bullets; both patients showed no damage to the cranial contents after the wound healed. Another patient illustrated the advantage of closing the defect in the skull for the removal of a bad mental impression. This patient was the captain of a schooner that went up and down the Chesapeake Bay. He was injured by the boom, making a large fracture of the skull which suppurated, and for which bone was removed. He was admitted to the Marine Hospital with

a defect as large as the palm of the hand in the temporoparietal region. We transplanted a tibial graft in this case and the wound healed promptly. The patient is now back and making his living going up and down the bay, whereas during the five years between the period of the accident and the repair of the defect he was unable to make a living.

Dr. Charles Bagley, Jr. (closing the discussion on his part).—I am much interested in Doctor Primrose's discussion of the foreign body paper, and feel that what he said concerning the case which developed meningitis and was operated on late is very pertinent. If surgical procedures for the relief of such lesions are to be useful, they must not be undertaken merely as a means of last resort. In the first case of our series operated on, the general condition of the patient was excellent, but operation was advised because of the large size of the missile and the belief that it would ultimately be the seat of a cyst or abscess. Exploration revealed a small abscess containing staphylococcus pus. Attack upon the abscess at the early stage made the operative procedure simple, the postoperative course uncomplicated and recovery complete. On the other hand another case of the series, operated upon after the abscess had been present for a number of months so that there was marked increase of intracranial pressure with grave symptoms, the operation was difficult, the postoperative course tedious and the patient recovered with marked diminution of vision. Thus the case which was operated early was simple from the standpoint of the patient and the surgeon, while the second case presented great difficulties because of the late operation.

Dr. Harry H. Kerr (closing the discussion).—There are two things I would like to speak about. I would like to answer Dr. Coleman about ether and local anesthesia. If he will reverse his practice and operate on his cases with the head in a high position under local anesthesia, he will reduce the hemorrhage and reduce the herniation. If he wants herniation to support the graft put the patient in the horizontal position after operation or have the foot of the bed raised. If he does this he will get all the bulging he wants. To reiterate a point not brought out because we have no neurologists present, I will say that the

gist of my paper is not the care of skull defects, but the reëducation of the paralyses. From the discussion the questions refer to differences of opinion about technic. The point I want to emphasize is the great amount of good that can be done for these cases with spastic paralysis. We all see cases who are paralyzed from head injuries. They are usually hemiplegic and bed-ridden at the beginning of the treatment, but many of them can recover. Of our cases at the Walter Reed Hospital all have regained power and have recovered about 33 per cent. of normal range, extent power and time of motion at this time.

EMPYEMA AT THE CINCINNATI GENERAL HOSPITAL DURING THE INFLUENZA EPIDEMIC

By Joseph Ransohoff, M.D.
Cincinnati, Ohio

One of the results of the pandemic of influenza of 1918-1919 is a literature extensive enough to make up a fair-sized library. In large proportion the papers published deal with the subject of empyema, and since for the first time in the history of the disease hundreds of thousands of men, in the prime of life, were congregated in close quarters, it is natural that the preponderence of the articles published treat of the disease and its sequelæ as observed in army camps and camp hospitals. It is for this reason that I feel justified in presenting for your consideration the empyemas which came into the surgical services of the Cincinnati General Hospital during the epidemic referred to.

An apology might seem indicated for the incompleteness of many of our records, and particularly the bacteriological, but when it is borne in mind that there was a tremendous dearth of physicians in civil life, and that at one time there were no less than seventy of our nurses down with the disease, said apology I trust will be accepted.

From October 1, 1918, to May 1, 1919, there were admitted to the Cincinnati General Hospital 3688 cases of influenza, of which 625 died, or a mortality of 16.6 per cent. Whereas this death-rate from influenza appears high, it must be remembered that only those seriously ill sought admission to the hospital wards. Among these 625 deaths there were 5 from empyemas which came under our surgical care. There were altogether

50 cases of empyema that were transferred from the medical to the surgical services, or that were primarily admitted to the surgical service. The latter was not often the case. In many of the 625 cases empyema was recognized by exploratory aspiration, but contributed little to the death-rate. As elsewhere, a very large proportion of the cases died from the toxemia incident to the pulmonary condition before either the patient or the empyema was in condition to warrant surgical intervention.

There doubtless were in many of these quickly fatal cases effusions of greater or less extent into the pleural cavities. The medical staff of the General Hospital recognized early that, as the necessity arises, influenza toxemias with moderate pleural effusions should be treated by aspiration alone, and that early surgical interference of greater magnitude was liable to be followed by speedy death. Whether as a result of the interference, or despite it, cannot be known. In our surgical services only two cases were aspirated in the cyanotic stage, but both of these patients died. It is evident that in these cases the cyanosis was not the result of pulmonary compression from any pleural effusions, but rather from the toxemia due to hemolysis. In two cases the aspiration of small quantities of turbid fluid was followed by recovery.

That the later interference in cases of empyema offers a better possibility of recovery, is manifest by our series of 46 cases operated upon by incision, with three deaths in the hospital, and one two days after release therefrom. The average stay in the hospital before operation was 14 7/10 days. If one considers that some of these cases were not admitted until a day or two after the inception of the disease it is a fair assumption that at least sixteen days were allowed to elapse before operative interference for the relief of the pleural exudate.

The average age of the patients was 21.6 years, a little lower than that of the average in military camps; 14 of the patients were under draft age. It might be inferred, therefore, that the low mortality which we achieved in the treatment of our empyema cases might be attributable to the lower age average of our patients, which would accord with the well-known fact

that in young subjects metapneumonic empyema is much more tractable to surgical interference than it is later in life.

We had, however, curiously enough, among the fourteen under draft age three deaths of patients, aged respectively fifteen years, sixteen years and five years; so that, on the whole, the incidence of the disease, so far as age is concerned in the civil practice of our hospital, does not differ materially from that which pertained to the military and camp hospitals.

It may well be claimed that the type of empyemas which were seen during our influenza epidemic differed in severity from that which was observed in military hospitals. I regret very much indeed that our bacteriological examinations were most incomplete. An apology, as already stated, must be found in the undermanning of our institution during four months. Nevertheless, we had 8 cases in which the streptococcus alone was found, 7 in which the pneumococcus was found, 9 in which both streptococcus and staphylococcus were found and 6 in which the streptococcus and pneumococcus were found.

Now the treatment which was instituted in all of our empyemas was that of drainage, with an immediate occlusion of the pleural cavity, after the manner described by me in a short article in the *Journal of the American Medical Association,* April 15, 1916. By it, or despite it, we had a mortality of only 9 per cent., and in 2 certainly, and I believe in 3 of our cases, there was a double empyema, and, of course, a bilateral drainage. In none of these three cases, however, did the disease affect the two sides synchronously. In each case an interval of from two weeks to twenty-one days intervened between the operation.

The mortality of empyema operations is ordinarily considered not to be very high, and yet we find "that in 299 consecutive cases observed in so excellent an institution as the Mt. Sinai Hospital, during the period of ten years, the mortality reached the formidable figure of 28 per cent[1]." A mortality, therefore, of 9 per cent. in 46 cases, some of which were bi-

[1] Moschowitz, A.: Surg., Gynec. and Obst., April, 1919.

lateral, warrants the publication of this report, and the assumption, or perhaps presumption, that the method of treatment had something to do with the low mortality.

The operations performed were for the most part under local anesthesia, and wherever ample room was obtainable in the intercostal space, rib resection was not resorted to. Under general anesthesia there were 17 operations and 29 under local. In 26 cases rib resection was performed and in 20 intercostal drainage without rib resection. An ordinary drainage tube, with collapsible tube attached with or without a shield, was used. In regard to the shield, I might, parenthetically, state that there is some danger of its coming from the rubber tube. In one of our cases, a lad, aged sixteen years, such a shield is still within the chest cavity. He left the hospital forty-one days after operation, without the slightest discharge. The roentgen-ray shows the shield in close relation to the chest wall. In most cases a shieldless tube was used and introduced through an opening just large enough to permit the introduction of the tube. The incision was made at the most dependent point for efficient drainage, but not so near the posterior midline as to interfere with the free effusion of the pus into a receptacle, usually a bottle. The pus, of course, was never allowed to escape rapidly, and I am quite sure that in that manner the fluttering of the mediastinum, which is such an element of danger in rapid evacuation of the pleural contents, was avoided. The pleural opening and the outer incision were at once made water-tight by sutures.

In only one instance did death occur upon the table, and this was in one of the extremely toxic cases above alluded to. Irrigation with the chlorinated soda or any solution was practised in none of our cases during the early postoperative stage, although from military hospitals come loud pæans of praise of this procedure. In the later stages, when the discharge continued, we resorted to the use of the Carrel-Dakin methods, and with good results. As a primary result, while the patients still are very weak, I believe that there is not a little danger connected therewith. It should always be borne in mind that

a considerable number of empyemas, and particularly those which followed the insidious creeping pneumonias of influenza, subpleural abscesses of sometimes greater but oftener diminutive proportions are discovered, and it is because of the rupture of one of these abscesses that the pleurisy in reality develops. The injection of an irritating solution, therefore, into the pleural sac is always associated with the danger of irrigating the bronchial tree, the only tree in which irrigation is contraindicated. In not a few instances in which the irrigations were practised later the fluid was expectorated by the patient, and further irrigations had to be desisted from. In only one of our cases did we have the unusual complication of a septic peritonitis. Briefly the case was that of a medical student in a training camp, who, because he did not like the surroundings in the military hospital, was discharged immediately after the Armistice as well, although he had been ill for ten days. He entered the hospital with an empyema, streptococcic in character, and was operated on forty-four days after the inception of the disease. Three weeks after the empyema operation he suddenly developed what seemed to be a perforative appendicitis, for which a laparotomy was done. There was found streptococcic peritonitis. The appendicular peritoneum was injected, but not more so than the rest of the peritoneum, with plastic lymph and seropurulent effusion. The patient recovered and left the hospital with a small cavity 266 days after his admission. Quite an open pulmonary fistula necessitated the discontinuance of the Carrel-Dakin treatment. This patient has been sent by the Government to Roswell, N. M., for tuberculosis.

The average duration of stay in the hospital after drainage was instituted was 43 days, at the end of which time twenty-nine patients left with the wound entirely or practically closed and the rest with considerable drainage. This seemingly high average is due to three patients remaining respectively 96, 203 and 266 days.

In looking for the end results of our cases, through the social service, we find that one man died shortly after leaving the

hospital; his condition at the time was very serious, and he was released against the advice of the physicians. Eight of the patients who recovered could not be traced by the social service. Of the rest one is attending the surgical clinic, with a slight pleural fistula, three have reëntered the hospital for secondary operations and the remaining cases have been found by the social service to be in good health and at work.

We may therefore state that our results with occlusion drainage have been satisfactory. The hospital mortality was 9 per cent., including one case removed against advice that died a few days after such relief. I am not aware of such satisfactory results having been published from any of the large military hospitals. In a comparative way it would be unfair to entirely charge our good results to the method of treatment alone, since the large airy quarters of our new permanent hospital necessarily would give better results in respiratory affections than the necessarily cramped quarters of hastily-constructed military camps. But this, however, is not alone responsible for our favorable statistics, since it is evident that the mortality of the influenza *per se* in the Cincinnati General Hospital of 16.6 per cent. is only a little less than the average in military camps. It is almost needless to say that in the after-treatment of our drainage cases the patient was quickly advised and instructed in the use of forced expirations by means of Wolfe bottles and in such thoracic gymnastics as would help in the expansion of the lung.

If I were permitted, finally, to interpret the experiences which we have had with the empyemas at the Cincinnati General Hospital during the period of the influenza epidemic, and their treatment, I would crystallize them in the following conclusions:

1. It is not the empyema which kills when it is a complication of influenza. Too early operative measures are to be avoided and to be limited to simple aspiration.

2. Operations done not earlier than the end of the second week give the best results. Rib resection is indicated only when insufficient room is at command without it.

3. General anesthesia is not necessary in most cases, but from our experience does not increase the mortality of the operation.

4. The old methods of drainage should be given up for some type of the occlusion method, by which the entrance of air into the pleural cavity is prevented and the egress of pus facilitated. A suction apparatus attached to the tube we deem unnecessary.

5. Flushing of the cavity with Dakin or other solution is unnecessary, except when defervescence does not occur, thereby indicating that the spontaneous sterilization of the cavity is not progressing normally.

6. The small pneumothorax which sometimes remains after the healing of a cavity as has been demonstrated by the roentgen-ray is negligible, since it disappears spontaneously in a short time.

7. Twenty of the operations were performed by myself, the remainder by various attending surgeons of the hospital, to whom I am greatly indebted for carrying out the suggestions which I believed were essential in securing so low a mortality in the treatment of our empyema cases.

8. The fact that we were enabled to secure end results in all but eight of our cases shows one of the many advantages of an efficient hospital social service.

DISCUSSION

Dr. Alexius McGlannan, Baltimore, Maryland.—With the same object in view as expressed by Dr. Ransohoff, namely, to put on record our experience in a civil hospital, in order that the records may be compared with the larger experience of military hospitals, last fall I took up the influenza-empyema statistics at the Mercy Hospital in Baltimore. We had admitted there, from October 1 until December 15, 800 patients with influenza or its complications. In this group there were 355 cases of pneu-

monia, and of this number 122 patients died. Of 70 colored patients, 11 developed pneumonia, and of the 11, 7 died. There were no cases of empyema among the black people, and the reason probably is that which was given at Camp Devens, namely, that the negroes died of pneumonia too fast to develop empyema. There were 23 cases of empyema with influenza pneumonia admitted to the hospital, who developed their empyema in the hospital or on the outside.

We operated with the closed method by means of the Brewer tube, a method I mentioned sometime ago in describing suction drainage. We introduced a Brewer tube through a resected rib in such a way as not to have a sudden pneumothorax or sudden outflow of pus from the chest. The end of the drainage tube was kept under water in a bottle under the bed, so that there was continuous negative pressure in the chest brought about by the flow of pus with expansion of the lung, and in the Brewer tube we had passed through a hole a No. 1 Dakin tube. We used Dakin solution from the start in the empyema cases, not so much with the idea of sterilizing the cavity as with the notion that the chlorinated soda solution would prevent the accumulation of coagulated lymph and give better mechanical drainage. We felt the amount of Dakin's solution in the pleural cavity full of pus was not likely to be effective in destroying bacteria, but it would help mechanically. Of our 23 patients, we lost 3. One of the patients died two hours after we had done the aspiration to remove the pus from the chest. We never got an opportunity to put in our tubes.

Another patient was one of the early cases before we learned the extreme danger of early operation. This one patient was a woman who had been brought in with influenzal pneumonia. She was pregnant, and we thought she might have a miscarriage. We operated on the empyema within ten days from the time of her admission to the hospital, about the thirteenth day of the pneumonia. She died in forty-eight hours with meningeal symptoms.

The average duration of the patient's illness before coming to operation was thirty-three days. Until it was made plain that aspiration would not give relief, operation was not considered. The average duration of the time of drainage was sixty-five days, the shortest thirty-five and the longest ninety-

four days. One case occurred in an infant five weeks of age. The child recovered. We have had no recurrences and no persistent sinuses. Our experience points to the great advantage of suction or syphon drainage and the value of the Brewer flanged tube in carrying out this procedure.

Dr. Charles H. Mayo, Rochester, Minnesota.—I shall not discuss the problem of methods of treatment of empyema, but speak for a moment on epidemic waves. The epidemic waves of influenza run mostly in periods of six weeks and then drop again. The epidemic may return and run much the same course. The height of the mortality occurs in the middle two weeks of the six. Those persons who die have empyema as a result of the streptococcus or the influenzal pneumonia, which last year was not in any way to be compared with the old types of empyema. Autopsy shows that the lung is large and fills the chest. This year there have been more of the common types of pneumonia. The white cell count is between 3000 and 4000 when the rate is high. As time progresses and the infection travels from person to person, the infection being taken in through the respiratory tract, the number of leukocytes increases and the epidemic recedes. We have reproduced influenza directly in guinea-pigs, taking the cultures from persons who have just died of influenza. Cultures from one of the most malignant cases in which death occurred at the end of thirty hours inoculated into a number of guinea-pigs produced fatal results within a few hours; the animals were literally drowned in the secretions from their lungs. The disease experimentally produced in one guinea-pig after another simulates the disease in man; the leukocyte count is low at first and when it begins to go up improvement and a lower mortality result. The patients who survive the early period and continue ill for two or three weeks pass through the various stages of leukocytosis.

Dr. James M. Mason, Birmingham, Ala.—In this excellent consideration of Empyema, Dr. Ransohoff mentioned that some cases remained in the hospital, and that some left the hospital still draining. This opens for discussion the reasons for prolonged drainage and the presentation of the plan which will most rapidly result in permanent healing.

At U. S. Army General Hospital No. 26, Fort Des Moines, Iowa, I had the opportunity of closely observing the progress of 125 cases of chronic empyema, which were sent to us from other hospitals after our hospital was designated as an empyema center.

The patients had been draining for from several weeks to as long as a year. Our observation was that the chronicity was due in large measure to insufficient drainage; so much so that in the 125 cases we had to resort to 35 or 40 secondary rib resections. Many patients had been subjected to the trocar operation, with a small rubber tube left in plural cavity.

I would not state that the so-called "closed operation" will not cure a certain number of the milder cases of empyema, but after that operation has been performed and relief is not speedy the patient soon reaches the chronic stage, in which this type of operation does not give relief, and should be subjected to rib resection to provide free and efficient drainage.

In other instances the external wound had been allowed to close too early, leaving a cavity which was not sufficiently sterile to remain empty and the empyema recurred, making secondary operations imperative.

In a third class of cases we found bad infections, with a history of prolonged suppuration, and, usually with insufficient rib resection or insufficient antiseptic irrigation afterward. The soft tissues had usually cicatrized, constricting the drainage tract, and in many instances the rib had reformed, leaving a small hole through which the drainage tube could be passed with difficulty. These cases had to be reoperated upon, with further rib resection.

On the advice of the Surgeon-General through Lieut.-Col. Moschcowitz and Major Dunham the plan which we followed was as follows:

An opening was made sufficiently large to place one drainage tube the size of the thumb, and from two to six Dakin tubes. If this could not be accomplished by dilatation of the sinus it was accomplished by operation.

The empyema cavities were irrigated with Dakin's solution every hour in the day and every two hours in the night. Improvement was manifest at once and was very rapid. In April we started with 120 cases draining and requiring irrigation,

and by August 4, at which time I was discharged from the army, the number was less than 20, with a still further reduction a few weeks later as reported in detail in November *Annals of Surgery* by Captain J. E. Wattenburg.

Dr. Ransohoff (closing the discussion).—I want to emphasize the good results that we obtained from the method of drainage, which was not particularly original with the closed tube, not a small drainage tube put in through a trocar, but a good sized drainage tube that does the work and which should be made absolutely water tight, and even with that plan of treatment you will get recurrences of empyema. I stated in my paper three of the patients returned with their empyemas having recurred. Whether these empyemas had closed entirely or not I do not know. That does not matter. Once a man has had empyema, if he has a *locus minoris resistentiæ*, he is liable to have empyema again. If a man has periostitis in one place it may occur years afterward.

Some years ago I saw a man who had necrosis of the scapula; he was shot during the Civil War through the scapula, and for twenty-five years had been entirely well, then had a recurrence. At the same time, I saw a man who had been shot during the Civil War through the great trochanter; for twenty-five years he was well, and at the end of that time he had an osteomyelitis of the trochanter again, so that we will have recurrences of empyema occasionally. This, however, is not exactly germane to the subject under discussion. There is one thing I cannot understand, and that is how some of these cases are made sterile, as they have been in France repeatedly, the edges of the wound freshened, the wound sewed up tight, and healing takes place, That is contrary to my way of thinking of the way in which wounds heal.

THE RESULT AND FEASIBILITY OF TREATING LYMPHANGIOMATA WITH INJECTIONS OF BOILING WATER

By Francis Reder, M.D.
St. Louis, Mo.

The characteristics possessed by lymphangiomata are such that no matter what the variety, be it nevoid, cavernous or cystic, their amenability to treatment furnishes a very unsatisfactory chapter in surgery. Fortunately these tumors arising in the lymphatic vessels are not of common occurrence. They are far less frequently observed than the blood angioma, to which they bear a close relationship, the difference being principally in the nature of the contents of the vessels or spaces.

In my service of ten years at the City Hospital, an institution of one thousand beds, I have had occasion to observe only four cases. The scarcity of patients affected with a true lymphangiomatous growth seeking hospital care must be ascribed to some extent to the fact that these tumors seldom threaten life, that they do not cause pain nor do they cause the individual to feel sick. Furthermore, lymphangiomas are usually congenital, and the thought of a mother taking her babe to a hospital for a small tumor mass somewhere on its body which does not cause pain is a rather remote one. When confronted with a tumor of any sort the thought uppermost in the surgeon's mind is whether or not the growth is a suitable one for excision. Extirpation is the radical and most satisfactory measure in the treatment of a lymphangioma—if the operation can be safely executed. In that form of nevoid lymphangioma

affecting the tongue, causing marked enlargement of that organ and forcing it to protrude from the mouth (macroglossia), partial removal by a cuneiform excision is peremptorily the only measure, even at the risk of causing progressive inflammation or lymph fistulæ.

A similar procedure, but with greater risk, can be undertaken when the disease has attacked the lip (macrocheilia). It is an expedient that carries with it the danger of extensive infection or exhaustive lymphorrea, and in lieu of the unsatisfactory results occurring from the operation it is to be recommended only in extreme conditions.

The cystic lymphangioma, the simple lymphatic cyst, usually met with in the neck, is perhaps the safest tumor permitting of extirpation. Such a tumor can usually be dissected out with little difficulty, as it is not intimately adherent to other structures. In contradistinction to these simple lymphatic cysts may be found the tumor of the cavernous lymphangiomatous type which is also found in the neck. This latter tumor formation presents characteristics not found in the single lymphatic cyst. Although they are lymph-containing cysts, they also contain a certain amount of solid tissue and are frequently a mixed structure, being both hemangiomatous and lymphangiomatous. These tumors have a wide extent, show an absence of encapsulation and are adherent to important structures which render their excision extremely hazardous and often impossible.

The cavernous lymphangioma is the most frequent of the lymphangioma and may occur almost in any part of the body. The lesion is usually found in the tongue, lips, eyelids, cheeks, lateral regions of the neck, pectoral region and upon the upper and lower extremities, particularly the hands, including the fingers, and the feet, including the toes. As a rule these tumors are ill-defined, as they do not present a sharp contour at their base. The tumor appears to become continuous with the normal surroundings, its cavernous tissue infiltrating the skin, sending out cone-like processes between the muscles and displacing and surrounding nerves and bloodvessels. To attack

such a growth with a scalpel would unquestionably invite disaster of some sort. With such tumors it is still a mooted question as to whether or not the best advice is not to interfere. An experience gleaned from sixteen cases inclines me quite willingly to abide by this advice. Nature if given the time is often most helpful in causing these growths to diminish in size or disappear entirely. These tumors are very susceptible to microbic influences and suffer attacks of inflammation. They become swollen and tender with redness of the overlying skin, the patient not infrequently showing a rise in temperature. An active suppurative process seldom results. After such an inflammatory attack has subsided the tumor is frequently found to have diminished in size. A repetition of such attacks may cause the tumor to disappear entirely.

In connection with these unusual inflammatory processes I wish to mention the cases of two babies, both affected with a cavernous lymphangioma of the left cheek. One of the babies was stung on the affected cheek by an insect. A sharp inflammatory reaction resulted. The tumor enlarged perceptibly. Four months later, after the inflammation had subsided, the tumor was found to have decreased fully one-third in its size. In the case of the other baby the condition of the cheek was not recognized and the physician made a half-inch incision into the most prominent part of the swelling. For three weeks a clear, sticky fluid exuded. The wound in the meantime became infected. The affected cheek enlarged to twice its size, the swelling extending well upon the neck. Six months later the inflammatory condition having fully subsided, the cheek was reduced to half its original size. This child was very sick and came near perishing.

It appears that a cavernous lymphangioma is particularly prone to an inflammation of a phlegmonous type, rarely evidencing suppuration. Only when through a mistaken diagnosis an incision is made into the tumor, ingress of pyogenic microbes through such an infection atrium may cause a suppurative inflammation of the walls of the infected lymph channels and the interstitial connective tissue. Such an infection may

be very severe and may involve the entire tumor, attended by all the risks of life incident to septic infection and pyemia. Rather than invite a surgical calamity these tumors are being looked upon as inoperable. Although a cavernous lymphangioma is of slow growth, often remaining stationary for some time, it may show a decrease in size or it may show a rapid increase in its growth. It is usually during the progressive enlargement of the tumor that relief is sought for the patient. In an endeavor to imitate nature's course in destroying these tumors through simple inflammatory processes, injections of alcohol, tincture of iodin and 1 per cent. solution of zinc chloride into the tumor have been instituted. The intention was to produce an aseptic thrombosis which would render the affected part of the tumor harder, resulting in the arrest of growth. The eventual removal of the thrombosis is followed by obliteration of the vessels by granulation and cicatrization.

Although this measure seems logical it appeared to me that the solutions mentioned were only severe chemical irritants and entirely too drastic in their action to be injected into so sensitive a tumor. A lymphangioma being analogous to an angioma, and having had most gratifying results with hot-water injections in the latter, it occurred to me to subject the lymphangiomas to a similar treatment. So far eight cases have been injected with boiling water. In comparing the results obtained in the lymphangiomas with those of the hemangiomas it must be said that they have been somewhat disappointing. This must be attributed to the difference of the fluids in these tumors. In the hemangiomas the solid tissue elements are more prone to favorable metamorphic changes than those of the lymphangioma. It was found difficult to transform the soft tumor of a lymphangioma into a solid mass, and the boiling water could only be introduced under strong pressure, thus endangering the adjoining tissue.

Furthermore, it was difficult to judge when the tumor was sufficiently injected, and the only skin sign which could give positive evidence was a slight superficial epidermic detachment. This was not desirable, inasmuch as it invited infection. The

reaction following the injection seemed unusually severe when compared with the reaction following the injection of a hemangioma. For twenty-four hours the patient gave evidence of feeling sick and usually registered a temperature of 100° to 102°, with a pulse of 100 to 110. When the reaction had passed off, which was generally after the third day, the feeling of euphoria returned. The increase in the size of the tumor after the injection, although considerable, bore a minor ratio to the increase seen in hemangiomas after injection. Inflammatory processes seemed active and prolonged, the skin giving evidence of the severity by a marked reddish discoloration. Retrogression seemed very slow. It required from 4 to 6 months to show that the tumor had decreased in size. In the case of a baby with its left foot about four times its normal size, it required two years for the foot to attain the size to be fitted with a shoe. Subsequent injections are almost impossible to be given if the initial injection has been a thorough one. The tumor mass is so hard that no hot water can be forced into it.

It must be said that of the eight cases injected with boiling water all have been benefited; in none, however, has the tumor entirely disappeared. In four of the cases in which the seat of the lymphangioma was either under the pectoral muscle on the flexor side of the forearm or on the inner side of the leg the growth was reduced more than two-thirds its original size. These were adult patients. In one case of a boy, aged nine years, where the tumor was situated in the hollow of the external ear (concha) and as large as a guinea-egg, the growth almost entirely disappeared nine months after the hot-water injection. In two cases in which the lymphangioma involved a hand, including thumb and several fingers, the resulting decrease of the swelling was about one-half its original size. The thumb and fingers, however, showed but little decrease. These patients were respectively two and five years of age.

In one case in which the left foot and all the toes showed a marked lymphangiomatous growth to the extent of about three times the normal size, one injection reduced the swelling to one-half the original size. The toes all showed some decrease;

the decrease, however, was far less when compared to the decrease which took place in the foot.

The clinical characteristics of a lymphangioma fully disappeared after a hot-water injection. Instead of being a tumor which is soft and of a relaxed consistency the boiling water transforms it into a firm and hard mass. This is the change desired, as it prepares the tumor for absorption and obliterates the tendency of a recurrent growth. Of this I can speak with certainty, as none of the lymphangiomas injected have so far manifested evidence of a fresh growth. Some of these injections were made six years ago. Three cases of lymphangiomatous enlargements of the cheek in babies, which have come under my observation, were not injected, as the objections by the parents were of such a nature that the risk and responsibility were too great for such an undertaking. As an instance the case of a boy, aged five years, may be cited to illustrate the untoward consequences which might arise in the course of a lymphangioma which has been injected with boiling water. This lymphangiomatous growth involved the right hand, thumb and all the fingers, excepting the little finger. Because of great swelling of the hand and fingers the hand was useless. Its weight caused the boy to allow it to hang limply by his side. This tumor was injected with boiling water. The reaction, which was moderately sharp, passed in three days, enabling the patient to be up and around as usual. He was a boy in very good health. Ten days after the injection, while playing in wet sand, he developed a sore-throat. The family physician put him to bed. Four days after the attack of sore-throat the hand began to take on all the clinical characteristics of a phlegmonous inflammation. Repeated chills, temperature of 104° to 105°, delirium, vomiting and the severest systemic disturbances crowded themselves into a period of ten days, when the condition began to assume a more favorable aspect. During the inflammatory attack, because of the great swelling in the hand, the intense redness and gloss of the skin and the sense of distinct fluctuation, it was deemed justifiable to make tension incisions. These were made. I am frank enough to admit

Fig. 1.—Lymphangioma of right hand, thumb and all fingers, except little finger. At left, dorsal surface; at right, palmar surface. One injection of hot water was given. A severe phlegmonous inflammation developed. Three months later the hand and thumb showed a marked decrease in size (about one-half), but the fingers gave little evidence of decrease.

Fig. 2.—Lymphangioma of left foot involving all the toes. Two injections of hot water were given at a three months' interim. One year after the last injection the lymphangiomatous swelling had decreased two-thirds its original size. Shrinkage of toes was less marked.

Fig. 3.—Lymphangioma of left leg immediately above ankle on inner side. The lymphangiomatous swelling involved the foot and all the toes. One injection of hot water caused shrinkage of the tumor to one-half its original size, six months later.

Fig. 4.—Simple cystic lymphangioma of neck, removed by excision.

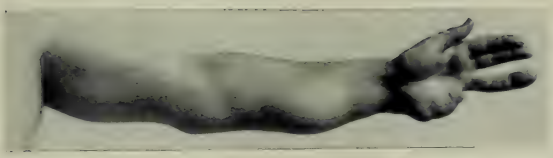

FIG. 5.—Lymphangioma involving palmar aspect of left hand, ring finger and inner aspect of forearm. The little finger on account of its large size was amputated six years ago at request of patient, it interfering with his work as a jeweler. He also asked that the ring finger be amputated, but this request was refused. One injection of hot water into the ring finger, the palm of hand, and the tumor on the forearm caused a shrinkage of the lymphangiomatous swelling fully one-half. He is now able to perform his work as a jeweler with greater facility. His condition did not bar him from entry into military service.

FIG. 6.—Lymphangioma of left cheek. Marked increase in growth in last two months. This tumor was not injected.

that I expected to find pus, but instead of pus there exuded a thick, sticky fluid. It did not appear to me that the tension incisions benefited the condition, and perhaps it would have been better had they not been made. The condition of the child during this time was desperate, and I asked permission to amputate in the middle of the forearm; this request was refused. After ten stormy days the inflammatory condition began to subside and three months later the last of the incisions had healed. This was a great relief, inasmuch as it is known that lymph fistulæ are very prone to form after incising a lymphangioma. Perhaps the influence of the boiling water upon the lymph was responsible in preventing the formation of fistulæ. It required six months for this child to fully regain its health. The lymphangiomatous hand has decreased about one-half its original size. The thumb and one finger have also decreased, but less than the hand. There is no doubt that the infection in this case was caused by the sore-throat, the micro-organisms being transmitted through lymph channels.

Inasmuch as a lymphangioma favors an inflammatory invasion upon very slight pretense, any measure for its cure or palliation, be this measure boiling water or a chemical irritant, must be instituted with great risk, with a thorough understanding of the probable clinical course the measure might excite in the tumor and with a courage ample to meet any disappointment.

DISCUSSION

Dr. Joseph Ransohoff, Cincinnati, Ohio.—Dr. Reder was good enough to take two of my cases of lipoma of the cheek, neither of which could have been benefited by anything but excision. It is rather remarkable that one of these cases occurred early in my practice. After an interval of about twenty years the patient turned up with a tumor of the cheek. In the interim both of these cases turned up. He had associated with the lipomatous condition lymphangioma. The first case was not associated with lymphangioma. The first case proved to be a lipoma

which had undergone myxomatous change. I would call the attention of the essayist to a book published by Dr. Pusey on lymphangioma which perhaps he has not seen. This book contains all there is known concerning these tumors.

As to the first picture the essayist put on the screen, which is supposed to be a lymphangioma, I have my doubts about it. It looks as if it is a pure hydrocele of branchial origin. We do have, of course, lymphangiomata of the neck oftener than anywhere else, congenital in character. These cases are almost invariably infarcts, but there are cysts, and those who have made a study of the subject know that many of these cases of lymphangiomata of the neck show there is an effort on the part of nature to span some defect in these organs. Anomalies of the arteries are known, but anomalies of the large trunks are not so well studied. There is a defect caused in the internal jugular vein, and there is an abortive effort on the part of nature to replace this vein by lymphatics, and, of course, when she tries to do this she overdoes it. We have these lymphatic cysts which should never be touched by operation.

I have had no experience with injecting lymphangiomata of the neck with hot water, but there is an analogy between a lymphangioma and a hemangioma. When it comes to the latter I have not operated on these cases for a number of years. I do not know of a single condition in which radium plays a more beautiful role than in the removal of these tumors. There is no other condition in which it answers more admirably than in these cases. We have had one case of lymphangioma in which we used radium, but the mother of the patient saw so little change that she finally discontinued treatment. I am sure, in the ordinary cases, I would use radium rather than resort to operative interference, because if you operate upon these cases and do not get the tumors out entirely, you will have a fistula which will bother you for a very long time.

BLASTOMYCOSIS WITH REPORT OF A CASE DYING FROM ABSCESS OF THE BRAIN

By John T. Moore, M.D.
Houston, Texas

I find that the *Transactions of the Southern Surgical Association* contain no record of a case of blastomycosis. The knowledge of this disease does not seem to be as widespread as its importance would suggest. A large percentage of the surgeons with whom I talk have not seen a case.

Although the literature on the subject has grown to be rather extensive, such a system of surgery as the recent one by Warbasse dismisses the subject with less than eight lines. Bevan, of Chicago, who has seen enough of the disease to have a respect for its importance, devotes a number of pages to its discussion in Lexer and Bevan's *Text-book on Surgery*. Their article is a most excellent one, the best I have seen in a surgical text-book. The text-books on diseases of the skin give good descriptions of the cutaneous lesions, but little is said of the more important phases of the disease, *i. e.*, the systemic involvement of the various organs of the body. Practically any or all the organs may become involved.

Many instances of failure to make a diagnosis are found in practice. This probably occurs on account of our failure to keep in mind that this disease is not so uncommon and that it can and does involve tissues and organs other than the skin, and often produces lesions similar to tuberculosis, syphilis and other systemic diseases. The disease is an important one both from a medical and surgical point of view, as it frequently begins with very severe constitutional symptoms before any

showing of a local condition appears, while in other cases the disease, at first local in the skin, becomes systemic and usually fatal.

It is generally accepted now that the organism first described by Dr. T. C. Gilchrist, of Johns Hopkins Hospital, is the pathogenic agent in both the local skin lesions and also in the various systemic forms of the disease. Dr. Gilchrist, it seems, presented his report of a case in 1894 to the American Dermatological Society, and later published a most complete study of the organism in Johns Hopkins Hospital Reports in 1896.

The disease at that time was regarded as entirely a local one, hence the name, blastomycetic dermatitis. There are now in the literature quite a number of systemic cases, the first one being reported by Busse and Buschke. The name has consequently been changed from that of blastomycetic dermatitis to blastomycosis of whatever organ it may involve, systemic and local. Many of the writers speak of it as the "Chicago disease" on account of the large number of cases reported from there. I am inclined to think that as a knowledge of this disease grows it will become more widespread in its distribution. In fact this has already happened, for cases are being reported from all parts of this country and also from foreign countries.

There is no need for me to go into a description of the organism, as there is available a number of well-written articles by authors who can do the subject far better justice than I. No one seems to have presented much of importance about the organism since Gilchrist's classical paper in 1896. The source of infection is still an unsolved problem. Evans has reported a case of infection through a punctured wound. Montgomery in an analysis of 44 systemic cases shows that 42 of these had a lung involvement. The frequency of lung infection has led to the idea of this being a common avenue of entrance. Others have suggested the intestinal tract as the avenue. The tongue has been shown to be the primary seat of the trouble. A general lymphatic distribution of the organism has been shown by Le Court (*Johns Hopkins Hospital Bulletin,* 1915). I have

read of one case that seems to have received the infection through an injury by scratching the leg against a barbed wire fence. I have a case reported by personal communication from Dr. M. B. Stokes, of Houston, who was burned on hands and wrists. Eighteen days after there was a peculiar papillomatous appearance, which upon examination showed blastomycetes; hence this case seems to have been infected in some way following the burn.

Our case got the infection through the mouth apparently. His trouble began in the lower wisdom tooth, and you will note that he had the habit of keeping a splinter of some kind in his mouth.

The history is as follows: Case No. 2364, G. W., aged seventeen years, schoolboy. Born in Texas. Referred to me by Dr. John H. Foster, November 26, 1918, for what was diagnosed a necrosis of bone in the left temporal region. The patient was a well-developed and muscular young man; weight 156 pounds and 5 feet 9 inches in height. Color good. Does not look very sick. Family history: Mother and three brothers living and in good health. His father died of paralysis at the age of forty years when the patient was a boy nine years of age. The following history of the father was obtained: Grant W., aged forty years, carpenter and farmer, born in Illinois, height 5 feet 8 inches, weight 160 pounds. Moderate habits. Healthy up to time of last illness, with exception of one spell of malarial fever ten years previous to last illness. Was taken down with chills and fevers, pain in back and lower limbs; treated for malaria two weeks; went to Hot Springs, Arkansas; hot baths made him feel worse. One week after began taking baths right leg from hip to foot became paralyzed, came on suddenly; next day left limb was affected. Complete paralysis from waist down. Prior to paralysis had considerable pain in back, with occasional spells of nausea and vomiting; chills and fever every day, sometimes several chills a day; fever would go very high; no pain or nausea after paralysis set in; died one week after first attack of paralysis, May, 1910. Lost in weight considerably during illness.

Personal history: Active, vigorous boy, taking part in all the athletics of his school. Does not use tobacco or alcoholic liquors of any kind. He says that he has a habit of holding a splinter or stick of some kind in his mouth. Is neat and clean in his habits. Studies hard and stands well with his classmates. Previous diseases: Had measles and whooping-cough when a child; pneumonia at the age of seven. Well and vigorous up to the time of present trouble. Present disease: On August 9, 1918, trouble began in the left lower jaw, region of the wisdom tooth. Thought he had toothache and consulted a dentist, who told him that as soon as the tooth got through the gums he would be all right. The pain gradually extended to the entire left side of the face. The dentist claimed that there was inflammation about the wisdom tooth and advised hot applications to the side of the face. Jaws began to get stiff and could only partly open the mouth. The latter part of September the dentist forcibly opened his mouth and extracted the left lower wisdom tooth, which tooth was found not diseased. The pain and swelling in the face and side of the head continued. Area above the left ear became more swollen than the other parts of the face. This swelling was lanced by a doctor on October 1, but he got only bloody serum, no pus. The pain grew more severe and the doctor advised his return to Houston, where he arrived about November 15, 1918. As the patient continued to grow worse he consulted Dr. J. H. Foster, a specialist on the ear, nose and throat. Dr. Foster had a Wassermann made, but the reaction was negative. The roentgen-ray and other studies showed no mastoid involvement nor any involvement of eye, ear, nose or throat.

On November 26, 1918, Dr. Foster asked me to take charge of the case. At this time there appeared to be three distinct abscesses or gummata, one just above and behind the left ear, another just in front and a little above the ear, while the third swelling was about midway between the ear and the outer canthus of the left eye and a little above the zygoma. The skin over these swellings had rather a reddish blue appearance and the areas fluctuated upon pressure, but were rather firm to

the touch. The areas were quite suggestive of actinomycosis or blastomycosis, both in appearance and to the touch.

The pus showed upon examination the organism of blastomycosis. It was decided to open, curette out and drain the swellings. This was done very thoroughly under ether anesthesia, December 7, 1918. The material was somewhat thick and cheesy and very readily came away with a sharp curette. Underneath the pus and cheesy contents of the abscesses was some necrotic and granular material, which being curetted away left a bleeding surface. After curetting these wounds they were swabbed with strong tincture of iodin and packed with iodoform gauze for twenty-four hours. Upon removing the packing Dakin's tubes were introduced and Carrel-Dakin's solution used for three or four days. After the wounds appeared clean alcohol dressings were applied. Patient was put upon potassium iodide, as first advised by Bevan, and the dose increased up to about 240 grains per day.

On December 14, 1918, the abscesses did not appear to be clearing up so well, so these cavities were again curetted thoroughly. After a few days he was given the roentgen-ray treatment by Dr. B. T. Vanzant, and in the course of sixty days the wounds appeared to be practically healed. It was observed that at about the center of each healed abscess there appeared a small elevated and soft area. These were kept opened up and syringed out daily with sulphate of copper solution, 1 per cent. The copper solution seemed to have a very destructive action on the organisms, and under this treatment the small abscesses would heal. We tried silver, lysol and bichloride solution, but the copper was by far the best of them.

The patient was kept in the hospital from December 6, 1918, to January 16, 1919, and carefully fed, and in every way thoroughly treated. When he left the hospital we felt pretty sure that he was safely on the road to recovery. The roentgen-raying had darkened the skin as from sunburn and the tissues seemed thoroughly healed, though there was evidence of considerable fibrous tissue at the sites of the healed abscesses. The

fibrosis seemed a favorable condition to prevent further spread.

He continued to do very well until about June, 1919, when there appeared evidence of involvement of the tissues in the orbit just above the left eye. A good oculist was consulted and the abscesses opened and syringed out with sulphate of copper solution 1 per cent. The eyeball gradually began to bulge forward, notwithstanding the drainage of the lesions in the upper lids seemed free. From time to time the removal of the eye was discussed, but nothing was done until September 9, 1919, when the eye was enucleated, with the following comments of the oculist, Dr. Wallace Ralston:

"On or about August 1, 1919, the left eye showed signs of being pushed forward (exophthalmos). There were noted two discharging sinuses of the upper lid: one about the middle of the lid under the orbital eminence and the other just outside the outer canthus. These openings led to a point about one inch in depth, where they came together. This protrusion of the eyeball gradually became more pronounced until the lids could not cover the eyeball. The conjunctiva of this eye became very chemotic, irritated and angry in appearance. The cornea became hazy. Before the cornea became too hazy it could be seen with the ophthalmoscope that the optic nerve was quite pale (optic atrophy). The retina showed slight changes, the vessels being somewhat narrowed and the entire background appeared slightly paler than the right. Motion in the eye was very restricted in every direction, the ball being almost fixed in the orbit or almost out of the orbit proper. It becoming clearly evident that it was necessary to do something more radical, as the eye could not be saved, on September 9, 1919, the eye was enucleated. A large mass, the size of an eye, about one inch in diameter and very hard, was found deep in the orbit on the temporal side. Feeling that this must be a very tense abscess or cyst, scissors were used in opening the same; when so opened a large quantity of pus was evacuated. The tumor, of course, collapsed. Dr. Martha A. Wood will report as to the laboratory findings of a specimen of this pus."

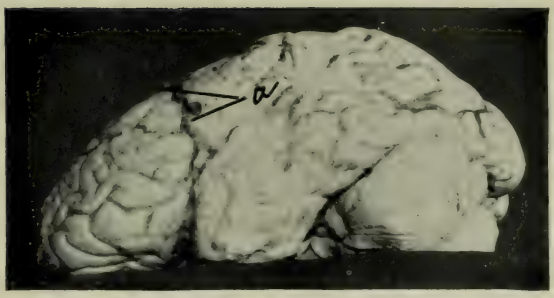

FIG. 1.—Photograph of brain, showing opening of abscesses at *a*.

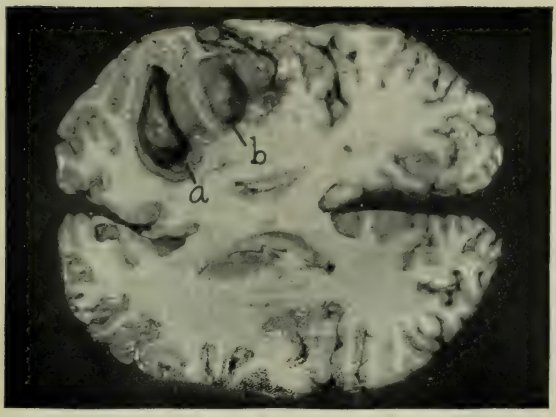

FIG. 2.—Section through brain, showing two large abscesses, *a* and *b*.

The patient was allowed to leave the hospital three days after the enucleation of the eye. He was feeling very well, though he had become somewhat emaciated. On September 16, 1919, a small abscess about the left frontal eminence was opened and much pus of a foul nature evacuated. On September 17, he was sent back to the hospital on account of a convulsive seizure.

When seen in the hospital he presented nothing very different from a patient who had an attack of epilepsy. We suspected cerebral involvement, feeling that the pus drained away came through the skull. The reflexes were normal and no evidence of involvement of cranial nerves appeared. Convulsions which were partially Jacksonian in type continued; four on the 18th, two on the 23d and twelve on the 24th. Paralysis of the right arm and leg and partial paralysis of the face developed on September 21. Death occurred on October 12, 1919.

Laboratory Report and Post-Mortem Report by Dr. M. A. Wood, Case G. W.—Blood: Wassermann test was negative on November 26, 1918 (Dr. E. F. Cooke) and again on December 9, 1918 (Dr. M. A. Wood). Blood cultures were made on December 9, 1918, and were sterile after two weeks. A blood count, made September 24, 1919, showed white blood cells, 40,000; polynuclears, 94 per cent.; small mononuclears, 6 per cent.; large mononuclears, 0; eosinophiles, 0; basophiles, 0.

Urinary examination made at various times showed no abnormality. December 6, 1918, examination of pus from the lesions on the side of face showed blastomycetes of varying sizes, large and small, with some budding forms. Examinations were made April 11, 23 and May 27, 1919, and the pus from these lesions always showed similar variations in size and character of the organisms.

The eye: In the abscess in the orbit posterior to the eye, after the eye was removed, were found many large-sized blastomycetes. These large blastomycetes were contrasted particularly with the small size of those found in the pus from the

abscesses of the brain. No other organisms were found in the pus from the deep orbital abscess or from the brain abscesses.

The brain and membranes: Sections from the dura mater through one of the thickened portions show on the meningeal surface an extensive round-cell infiltration, with proliferation of the endothelial cells and connective-tissue cells and formation of giant cells. No blastomycetic organisms were seen. The proliferation of connective-tissue cells extends throughout the entire layer of the dura. Sections of brain tissue on the edge of the abscesses show, first, a zone of necrotic material, next a zone in which polynuclears, eosinophiles and connective-tissue cells predominate. Beyond this zone small round cells and connective-tissue cells are more prominent. No giant cells were seen. Some small blastomycetic organisms were seen in these sections.

G. W., post-mortem, October 12, 1919, on head of case of blastomycosis.—External appearance: The skin on the side of the face was dark red and rather contracted at various sites of old healed openings. Skin smooth in between healed lesions. There was noted one opening through the skull about one inch back of the left frontal eminence. Another opening near the lower end of the left coronal suture. Also an opening through the left orbit at the left and above the outer canthus. Practically all of the upper part of the left temporal muscle had been destroyed. The anterior one-third of the left side of the skull presented a worm-eaten appearance on the under surface, with the three openings through as mentioned. An exostosis of skull was seen on the outside near the left orbit. Dura thickened in patches over the anterior half on the left side and also along the falx cerebri. Outer surface of left cerebral hemisphere exudes pus from two openings into deeper tissues. An exudate was seen covering anterior one-half of temporal lobe, central portion of parietal lobe, some small patches over frontal lobe and areas along the intercerebral fissure. The vessels of both hemispheres were full of blood.

Sections through the brain show an abscess cavity, 3.4 cm. by 2.5 cm. in center of frontal lobe, extending to within 2.5

cm. of under surface of frontal lobe and communicating with upper surface through an opening in medifrontal gyrus about 1 cm. from the fissure of Rolando or central fissure. A second abscess cavity is shown separated from the first by a narrow zone of brain tissues .3 cm. wide. This abscess measures 2.8 cm. by 2.1 cm., is oval-shaped and extends downward for about same distance as first, its upper margin being about 1.2 cm. below surface of brain. The whole cavity lies under the central portion of the fissure of Rolando. No external communication had been made by this abscess.

Behind and to the outer side of the second abscess cavity was a third abscess separated by a narrow zone of brain tissue 0.2 cm. wide, irregular in shape, about 3.7 cm. long and ½ cm. at its widest part, with a communication of the surface just posterior to the fissure of Rolando and about 2 cm. above junction of Rolandic and Sylvian fissures. This abscess extended to about same distance from under surface as the others. Sections through caught all three abscesses at about same level on their under surfaces.

A further abscess cavity is seen on the mesial aspect occupying the central portion of the superfrontal gyrus, only a thin wall of brain tissue separating it from the exterior. This cavity measures 1.8 cm. by 1.7 cm. by 1.8 cm. The frontal lobe on the affected side bulges toward the right side and shows a difference of 1 cm. in diameter of the two frontal lobes.

Conclusions.—1. The infection in this case was probably introduced through the mouth from the splinters habitually carried in the mouth.

2. The treatment of the case was hardly radical enough in destroying the various recurring foci of the disease.

3. The eye should have been sacrificed earlier in the game and radium used in the orbit, as the roentgen-ray was apparently the best agent we used in the treatment and healing of the lesions on the face and neck.

4. The disease remained more or less local for a long time, notwithstanding its tendency to spread through the lymphatics and become systemic. No organisms were obtained either from

the urine or sputum, nor did we succeed in getting a culture from the blood.

5. The infection of the brain was possibly through the ophthalmic vein or through the veins of the scalp and emissary vein through the skull.

6. The study of the organisms in the different lesions and tissues showed a considerable variation in their size, those from the abscesses of the face, neck and orbit showing the large forms, while no large forms could be found either in the pus or the tissue from the brain.

7. There are many budding forms of the organisms, but no evidence of endosporulation, as in coccidoides.

References

1. Gilchrist, T. C.: Johns Hopkins Hosp. Rep., 1896, vol. i.
2. Busse and Buschke: Virchows Arch., 1895, vol. cxl.
3. Evans: Jour. Am. Med. Assn., January, 1903.
4. Montgomery, A. H.: The Surgical Clinics of Chicago, 1917.
5. New, G. B.: Mayo Clinic, 1916.
6. LeCount: Johns Hopkins Hosp. Bull., September, 1915.
7. Fontaine, Haasse and Williams: Arch. Int. Med., vol. iv.

THE PRINCIPLE OF INDIRECTION AS APPLIED TO ABDOMINAL SURGERY

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The principle of indirection is as old as the universe. Indirection has been one of the chief principles of strategy in battle for all time. The general by some means attempts to attract the enemy from a point which he expects to make solid. During the late war the Germans by their spy system and propaganda attempted to keep the Allies and the United States attracted to their own internal affairs by creating internal disturbances. The British by attacking the Dardanelles not only hoped to capture the Straits but expected to draw the attention of the German Allies away from the principal scene of battle. Engineers direct a large stream of water to one side or through a flume remote from the point at which they expect to construct a dam. The mother bird flutters and scolds and makes a tremendous noise, not in the neighborhood of her young, but at a distance away, in order to attract the attention from her young. This form of strategy we refer to as "indirection."

When an injury occurs in a normal body the forces of defence and reconstruction are immediately called upon and soon arrive at the seat of action and start reconstruction. Reconstruction of a given part is antagonized by the necessary motion and activity required to carry on the normal functions of the body without interruption. It is further antagonized, held back and even prevented by parasitic enemies—the forms of various bacteria or germs. These bacteria come to feed on

the injured tissue and procreate their species. If they are of sufficient virulence and numbers they may greatly retard or entirely prevent repair of the lesion. From this general standpoint we take up indirection as applied to abdominal surgery.

Indirection is used for two purposes: (1) To direct functional activities away from the lesion or diseased area. For example, gastro-enterostomy transfers the function of the ulcerated pylorus to an anastomotic opening at a distance away and allows as little disturbance as possible. The John Young Brown operation of ileostomy diverts the fecal contents and intestinal functioning from the colon and thus allows the healing of various lesions in the large intestine. This phase of indirection is so commonly used that we shall dismiss it at once. The second purpose of indirection is diversion of septic materials from a point where repair is to be accomplished.

Our first systematic study of this subject was directed to the closure of fecal fistulæ by remote or indirect subperitoneal drainage. The direct closure of the fecal fistulæ up to this time had usually been a failure, except by opening the peritoneal cavity and doing extensive resection. This was due to the fact that the field was essentially septic; no amount of sterilizing would so cleanse it that the wound would heal by primary union. Direct drainage in the wound almost invariably resulted in reëstablishment of the fistula. It occurred to me that the only possible way of closing such a fistula by primary union would be to provide ample indirect drainage which would divert the septic material and draw it in all directions away from the field of repair. This was brought about as follows:

1. Dissect the old scar of the former incision down to the fat and make an incision around the fistulous tract outside the scar tissue, and, including a small strip of skin, direct the point of the knife slightly away from the fistulous tract so that the point first comes in contact with the aponeurosis about one-half inch away from the fistula. This is done to avoid the possibility of opening the peritoneum. This incision should be long. It should be made to extend two or three inches above

and the same distance below the incision surrounding the fistula, in order to give ample room for separation of the layers (Fig. 1).

2. Dissect fat from the aponeurosis for as much as two inches on either side of the incision.

3. Make an incision through the aponeurosis, beginning at the upper end of the wound and coming toward the fistula and around it on to the lower end of the wound. A very narrow strip of aponeurosis may be left with the fistulous tract. Dissect the aponeurosis from the muscle for at least two inches on either side of the incision.

4. Dissect the muscle from the peritoneum in the same manner so that the peritoneum hangs loosely with the fistula standing out in its center like the crater of a volcano (Figs. 2 and 3).

5. The little margins of skin and aponeurosis which have been left attached to the fistula are now trimmed off.

6. If the fistulous tract is hard and cicatricial, making it way through the cicatricial tissue so it may turn in easily.

7. The edges of the fistula are turned in with linen sutures which are knotted on the inside (Fig. 4).

8. A second layer of chromic sutures brings the edges of this incision and the connective tissue over the peritoneum along with the scar tissue covering the turned-in fistula to add temporary strength and bulk to the closure. The peritoneum on the rest of the wound is now thoroughly dried with gauze or irrigated to make it as clean as possible.

9. Silkworm sutures are passed through the skin, fat, aponeurosis and a portion of the muscle about one-half inch or more from the edge of these layers. These sutures are left untied, space being left at each end of the wound for drainage (Fig. 5).

10. Suture the muscle loosely with a continuous catgut (Fig. 5).

11. Suture the aponeurosis with a strong, double catgut (Fig. 5).

12. Suture the skin with a horsehair buttonhole stitch (Fig. 5).

13. Place drains at each end of the wound. These drains are usually made of double rubber tube and extend down to the peritoneum (Fig. 6). The tubes should be pinned to the skin with safety-pins. A roll of gauze is laid along the wound and the silkworm sutures are tied over the gauze (Fig. 7).

Fig. 7 shows a cross-section through the fistula, in which are represented all the different rows of sutures, all the different layers of the abdominal wall and the spaces between the layers which have resulted from the dissection, and which spaces are for the purpose of draining away septic materials from the suture line. The lateral spaces between the fat fascia, muscle and peritoneum serve as drainage channels to conduct any septic material or fluid around the line of sutures to the drains at the ends of the wound (Figs. 6 and 7). The sutures are represented as interrupted sutures for the purpose of illustration, but they are actually placed as a series of continuous sutures, except the inclusive silkworm sutures.

Fig. 6 represents a longitudinal section through the fistula and abdominal wall. This figure is made to represent the effect of sutures holding the various layers of peritoneal wall together without actually showing the sutures. The arrows represent the direction of drainage toward the tube and away from the point of reconstruction or line of sutures. The small arrows inside the abdominal cavity indicate the direction of intra-abdominal pressure, which gently, but persistently, forces the fluid in the direction of the drainage tube. The spaces illustrate the method by which the lateral spaces are brought into contact with the drain. These sutures are allowed to remain for about two weeks before the horsehair and silkworm-gut are removed. At the end of this time union of the abdominal wall should be perfect. In the meantime any material which may have come from the fistula has been carried beneath the peritoneum and delivered to the surface through the opening at the point of drainage. At the same time a substantial granulation wall has formed around these tubes, leaving a sinus through which any further drainage from the subperitoneal space can take place. It matters not if the fistula

leaks. In fact, if a certain amount of fecal matter and gas does escape at the point of these drainage tubes, it simply shows that we have a good indirect sinus formed which we know will heal in due time.

This method of closing fecal fistulæ is almost invariably successful, no matter whether the fistula comes from a small intestine or a large intestine, provided it is located at a point where the layers of the abdomen may be dissected entirely apart, as shown in the technic, and further provided, of course, that there is no obstruction below the fistula. A wound thus made, thus sutured and thus drained, has in our experience usually healed by primary union without suppuration in the neighborhood of the stitches. In case previous operations for a closure of the fistula have been done it is sometimes found that a great deal of scar tissue is present and that the normal layers constituting the abdominal wall have been largely destroyed. This condition is sometimes found to exist to such an extent that it is impossible to separate the abdominal wall into its various layers. In such cases it may be difficult or impossible to close the fistula by the extraperitoneal method. I have had one such case which required an intrabdominal operation.

The fundamental principle of this operation is indirection. The essential points of the operation are as follows:

1. That the abdominal layers shall be separated for a sufficient distance from the line of sutures to provide ample drainage around the line of sutures between the various layers of the abdominal wall.

2. The drainage must be at a point remote from the original fistula.

3. The layers must not only be sutured individually, but collectively in that all the individual layers of sutures must be included in the grip of a row of interrupted silkworm sutures which pass around the various lines of sutures holding the three principal layers of the abdominal wall.

Fecal fistulæ, at the time the above-mentioned article was written[1], occurred quite frequently from drainage operations

[1] Annals of Surgery, June, 1907.

in cases of abscess following appendicitis, or following operations in which the intestine had been injured, or accompanying tuberculosis, or malignancy of the bowel. At the present time we have relatively few fistulæ following appendix operations, owing to the fact that the operation is done nowadays before an abscess is definitely formed in most cases. But the decrease in fecal fistulæ from this cause is more than made up by frequent therapeutic fistulæ which are to remain open for a few months, or even years, and finally closed. The closure of a therapeutic fistula is made much easier if the opening is made with extraperitoneal closure in view. If a colostomy or an enterostomy is made for therapeutic purposes it must deliver all the contents of the bowel and must be held out until it is desired to close it.

A temporary fistula is sometimes made in such a manner that a tendency to retraction takes place and the fistula does not deliver all the intestinal contents as the months go by. In order to make it possible to close the fistula it is necessary to suture the limbs of the bowel together, so that the Mikulicz plan of cutting the septum with forceps pressure may be done without danger of including an innocent loop of small bowel in the bite. Sistrunk and others have made a permanent colostomy by sewing the abdominal wall together underneath the loop of bowel. If it becomes desirable later to close such a fistula an intraperitoneal operation is absolutely necessary. We have therefore devised a method of doing a colostomy which combines the features of a temporary and a permanent colostomy and is applicable to either sigmoidostomy or transverse colostomy or ileostomy, which is performed as follows:

A loop of bowel is drawn up through a longitudinal wound in the rectus muscle. This incision should be from two to three inches in length. The mesenteric borders of the two limbs of the intestines are sewed together, leaving some space under the apex of the loop (Fig. 8). Two or three interrupted purse-string sutures close the mesentery back of this line of sutures to prevent a knuckle of intestine from becoming incarcerated in the space. Another line of sutures brings the free margins of

the intestines together (Fig. 9); thus two flat surfaces of the two limbs are brought together. The loop of bowel is now sutured by a continuous lock-stitch of chromic catgut to the edges of the parietal peritoneum. A similar continuous suture fastens the loop to the aponeurosis and muscle (Fig. 10). A tongue-shaped flap of skin, one-half inch wide at the apex and about two inches long, is dissected up from one side of the wound; a pair of artery forceps is thrust through the mesenteric space at the apex of the loop and the space is dilated. Through this space the strip of skin is drawn and sutured to the skin on the opposite side. A piece of rubber tubing is also passed under the loop of bowel on top of the strip of skin. This is for the purpose of carrying the weight and avoiding tension on the skin flap. The skin wound is then closed and the skin sutured to the loop of bowel with interrupted chromic catgut suture. In the course of ten days or two weeks the tube has served its purpose and may be removed. The colostomy has already been established. When it becomes desirable to close this fistula the septum, including the skin flap going across the wound, may be destroyed by pressure of the clamp after the Mikulicz plan. After a few days the fistula may be closed by remote indirect drainage, as has been described (Figs. 11 and 12).

In certain cases of gangrene of the bowel it is necessary to bring out the two ends and quit the operation very abruptly, in order to avoid too great a shock to the patient. In other cases a bowel may be torn during an operation for a septic condition on a patient who is ill prepared to stand a great deal of shock. Apropos of this condition I relate the following case:

A woman, aged fifty years, had had several operations—first two ends of the ileum were separate on the distal side (Fig. 15). piece of distal ileum and through the ileocecal valve into the two intestines sewed together (Fig. 16). The tubes were drawn out through the lower end of the incision and a quarantine pack the loops of intestines from coming down. A number of gauze wicks, surrounded above by rubber tissue, kept the intestines away from the openings (Figs. 16 and 17). About six days after the operation fecal matter began to escape around the

tubes. Finally the tubes came out, the gauze was removed and a clamp was placed, one blade in the ileum and the other in the cecum (Fig. 18). Pressure was gradually brought down until the septum between the two intestines was cut for about six inches. Finally the protective rubber tissue was removed and we had a fecal fistula, through which practically all the contents of the bowel escaped. The patient was then fed up as well as could be and gradually gained flesh and weight. The fistula became narrower up to a certain point and a certain amount of the fecal contents was passing through the rectum. The intestinal mucous membrane, however, had grown gradually to the skin, making a permanent fistula. About four months after the original operation we closed the fistula by remote or indirect drainage method (Figs. 1 to 7). The patient gradully recovered. The continuity of the intestine was entirely restored.

This will be sufficient to represent and illustrate all of that type of cases in which the emergency demands the bringing to the surface of an intestine in an infected area, such as gangrene, various forms and degrees of intestinal obstruction, etc. In other cases, it is necessary in treating a fecal fistula to open the bowel higher up, creating another fistula, which remains active and thereby puts at rest all the bowel containing the original fistula until it has been cured.

Apropos of this condition I quote a very striking example. The patient, a married woman, aged thirty-two years, came to me for treatment for what appeared to be a very serious condition. She gave a history of having an ovarian tumor removed about July, 1916, one and a half years prior to the time she came to me. The operation was done for an ovarian cyst. One and a half years later the cyst apparently returned, being of the intraligamentous variety. At this time the surgeon who did the operation found extensive adhesions of the sigmoid to the tumor, and in separating them he tore its mesentery and destroyed the circulation of the sigmoid, so that he had to do a resection. The cyst seemed to be infected; the entire wound was infected with fecal matter and the contents of the cyst.

An end-to-end anastomosis was made after the sigmoid was removed and the patient was put to bed in a serious condition. In the course of a few days the abdominal wound opened and fecal matter began to discharge. Before this discharge, however, the abdomen became large, as if a tumor had developed in it. After it was open fecal matter discharged very freely through the wound and also discharged later through the rectum. When the patient came to us, on January 6, 1918, she was in what appeared to be a certainly fatal condition. This was three months after the fistula had formed. The lower portion of the abdomen seemed to have a large accumulation of some kind in it. She had a fever of 102° to 103°, with a pale, waxy condition, indicating that the fistula might be either tuberculous or malignant. She was too weak to make serious investigation. It was necessary to take immediate action, so under local anesthesia the transverse colon was brought up through the left rectus muscle above the umbilicus; the limbs were sewed together and the knuckle was brought to the surface for a transverse colostomy (Fig. 19), preparatory to closure later by the Mikulicz plan combined with the extraperitoneal method described above. The bowels discharged through this wound. The patient improved somewhat, but not enough to give reassurance. Finally her condition became stationary. We decided it was time to attempt to remove the condition and close the fistula below.

On opening the abdomen the entire pelvis and lower part of the abdomen were filled with fecal matter, a gelatinous substance, pus, and what-not. The proximal and distal ends of the sigmoid, which had been sewed together at a former operation, had separated for a distance of probably an inch, so that while most of the fecal matter came out through the abdominal incision a portion of it went down through the rectum at times. The contents of this mass were scooped out, the pelvis cleaned out as much as possible and the two ends of the intestine brought together in the midst of this material and sewed together with chromic catgut sutures interrupted. No attempt was made to make the union water-tight. A very large tube

was first passed into the intestine, one end extending about four inches above the point of separation, the other extending down through the rectum and out through the anus, where it was pinned to the buttocks with a large safety-pin. The ends of the intestine were then sutured, as above stated, around this tube. The omentum was freed and brought down over the sigmoid at this point and back around it and tacked to the sigmoid for some distance below the point of union, but enough space left under the omentum to allow the escape of the septic material from the neighborhood of the sutured intestine to the drain, later to be placed. A large quarantine pack was then placed in the pelvis to take up quickly the remaining contents of the mass, which we had just removed. Rubber tissue was placed above the gauze pack so as to keep the intestines away from the wound (Fig. 20). The patient was very ill for a few days, but she gradually began to gain strength, the bowels moving through the transverse colostomy opening. The gauze pack rubber drain was removed. She remained in bed for six weeks while the wound at the lower part of the abdomen closed. The large tube passing through the rectum up into the sigmoid was allowed to remain a little more than three weeks.

The important points in this operation to be noted are the following: The intestines were brought together over a tube and sewed, with the idea of keeping the mucous membrane approximated as well as possible, without any hope of primary union from the sutures alone. The omentum was placed over the line of union for the double purpose of furnishing plastic material for healing and to prevent the pack or drain from coming into direct contact with the line of sutures, while the space under the omentum permitted drainage to the pack. The quarantine pack served the purpose of draining away the infected contents of the abdomen and holding the intestines back from the infected field.

At the end of about eight weeks the wound had practically healed. Water injected into the distal end of the transverse colon from the colostomy opening passed out through the rectum, and when injected into the rectum would pass out through

the distal segment of the transverse colon at the colostomy opening. This was permitted to go on for four months after the patient went home, which amounted to six months after the first operation. On the patient's return at this time water was injected, as just stated, and the continuity of the intestines seemed to be thoroughly established. The fistula and the drainage wound from the pelvis had entirely healed and had become solid.

We were not yet sure as to whether a union of the sigmoid was of such a character that we could rely upon it to turn the full fecal current through it, so we put on a clamp to destroy the septum in the loop of transverse colon forming the colostomy. After this septum was destroyed the fecal contents began to pass down through the large intestine through the sigmoid and the patient had formed stools. In other words, our anastomosis had been formed under great difficulty by the use of the tube and drainage. After this was thoroughly determined for a few days we closed the colonic fistula by the remote or indirect drainage method described above (Figs. 1 to 7). (See illustrations.) The patient has been well now a year, and is apparently in good condition.

In this case another application of the principle of indirection is brought out, namely, an intestine is sutured in the presence of pus and fecal matter without regard to its holding. The suture area is protected from within with tube drainage. From without it is covered with omentum, which is sutured to it with occasional sutures, leaving a space for drainage underneath the omentum. A protective quarantine pack is placed down over the omentum, and is made to hold the small intestines away from the infected area while it drains any infected material from beneath the omentum, and thus prevents the accumulation of pus and other fluids.

In connection with common bile-duct surgery, Moynihan in discussing the McBurney operation of transduodenal removal of a gall-stone called attention to the fact that 80 per cent. of the deaths following this operation are due to leakage, with resulting doudenal fistula. He advocates perfect suturing with reinforcement by the use of omentum. Sometimes even

this does not suffice, as infection may be present in the form of pus in the gall-bladder and bile tracts which require drainage. In such cases as these I have sutured the duodenum, sutured as much omentum as possible over the duodenum, and have placed a small quarantine protective gauze pack off to one side—usually on top and to the right of the omental flap, serving the same purpose as shown in Fig. 20. This takes up all the fluid, and in our experience has never resulted in a duodenal fistula. The omentum having been sutured to the duodenum prevents any danger from the drain. Moynihan in this same book takes up the question of choledocho-enterostomy or duodenostomy, and quotes a forlorn lot of cases, only one or two successful, which have been reported in the literature. The cause of death has been leakage and duodenal fistula.

By a strange coincidence it has been my privilege to do two operations of this kind for total obstruction of the lower end of the common duct, with enormous dilatation and the presence of stones accompanied by chills and fever and other evidences of infection. Curiously enough these two cases occurred within three days of each other or during the same week. I briefly report the two cases:

The first, presented for operation July 13, 1912, was fifty-two years of age, had been sick with gall-bladder trouble for two years, had lost 100 pounds, had chills and fever and was severally jaundiced, and altogether presented a very forlorn picture. On opening the abdomen and the duct, which was fully as large as the duodenum and which lay parallel to it, several stones were found, one of which was up in the hepatic duct and one was wedged in the lower end of the common duct, but could be dislodged. Even with the duct wide open in this way it was impossible to pass a probe into the duodenum. The duodenum was then opened and even at this time the probe could not be passed into the duodenum, consequently a lateral anastomosis was made between the common duct and the duodenum. After this a large amount of omentum was drawn up over the neighborhood of the anastomosis and tacked in places. A quarantine pack was placed to the right and on top of the omentum. The result was uninterrupted recovery. I have

seen the patient within a year and he has been in perfect health since.

On July 16 I was called by Dr. William S. Knox to see a man with severe jaundice, chills and fever, and loss in weight something like 65 pounds. History of long-standing gall-stone attacks. He was not only jaundiced but was in a very septic condition. The common duct was found dilated to probably three-fourths of an inch in diameter. A stone was impacted in the lower end of the common duct. The common duct was opened and the stone removed, when it was found impossible to pass a probe into the duodenum. The duodenum in this case was opened also. The probe could not be passed into the duodenum, therefore a lateral anastomosis was performed between the common duct and the duodenum. The omentum was sutured over and a protective quarantine pack placed over the right edge of the omentum. This man made a perfect recovery and was in good health less than two years ago.

In the presence of the amount of sepsis coming from these bile tracts and from the duodenum I am quite convinced that had I not placed the protective pack or some other device to take care of drainage these patients would probably have died from sepsis or duodenal fistula and would thus have given even a more forlorn report than those reported in cases in Moynihan's book. This operation, I may state, was suggested and practised by Riedel as early as 1888. His case, however, died from leakage.

Often in cases of delayed operation for gangrene of the intestine drainage becomes an essential after resection. However, if drainage is placed and the sutured ends of the intestine are permitted to come in contact with the drain a fecal fistula is very likely to result. Again the omentum is brought to the field of operation and is tacked to the intestine covering the line of suture. A large protected gauze pack placed at the lower part of the abdomen, to rapidly take out the infected material, is the best procedure I have tried, and I think has materially reduced my death-rate from these serious conditions.

Often, too, the bowel is torn deep down in the pelvis in the presence of pus, fecal matter is added, and altogether a very

septic field is present. To suture this bowel without drainage is to invite disaster either in the form of a fistula or death, and, if a drain is placed so it comes in contact with the line of suture, a fistula is practically certain. In such cases the omentum again comes into play if it is available. It is tacked around the point of suture, a rectal tube is inserted and a quarantine pack placed down on top of the omentum. However, occasionally omentum is not available. It is too short or held out of the way by adhesions. In such cases I have resorted to the following measure: A loop of ileum at a convenient place is cut in two. The end of the proximal segment is attached to the side of the distal segment a few inches from this end. This end of the distal segment is turned in, first by a linen purse-string suture reinforced by a second linen purse-string suture and still further reinforced by a row of interrupted catgut sutures. This extraordinary precaution, of course, is presented to prevent a possible fistula from this end. This free end of the intestine, with attached mesentery, is to be drawn down over the fistulous wound and tacked there, thereby serving the same purpose as omentum. I think it is very important, however, that we use the end of the distal segment always, so that the normal peristaltic wave will empty the dead end so used. I think the cases of dilated ends reported following lateral anastomosis are due to the fact that the proximal dead end is dilated by the peristaltic wave coming down from above. Thus it will be seen (and it is almost paradoxical) that we have far better success in the cure of these deep internal fistulæ by indirection with the use of drainage than by any other method. We have succeeded in closing the worst forms of fistula in this way, involving practically all of the segments of the intestinal tract. This brings us up to the most knotty problem in this line which yet remains unsolved, namely, the cure of a biliary fistula after the common duct has been destroyed and the gall-bladder removed.

Sullivan attempted to establish connection with the intestine through a rubber tube, one end of which was fastened in the bile duct with catgut sutures and the other end passed into the intestine. To the end of the tube in the intestine a small

sponge was attached to give the peristaltic wave a chance to finally pull the tube out. Omentum was sewed over the tube and a fistula resulted after the tube passed into the intestine. Clinically I believe this operation has failed, as the fistula has closed in every case, so far as I know.

Wilms attempted to make a permanent bile duct with a tube, one end of which was attached to the bile duct and the other end passing into the intestine.

Dr. C. H. Mayo has modified this by using a dumb-bell tube.

Dean Lewis has attempted to make a bile duct out of fascia lata or fascia of the abdominal wall. I think all these operations are doomed to failure because they are not based upon physiological principles. The best they can do is to establish a cicatricial fistula. It is probable the only way to reconstruct a common bile duct and make this procedure uniformly successful is by bringing mucous membrane in contact with the proximal end of the severed bile duct. In my opinion this can only be done by the principles we have set forth in this paper, namely, remote or indirect drainage. We are now beginning a series of experiments on dogs to see if our plan will work out. Unfortunately the dog's anatomy makes the operation more difficult than in the human. Our plan is as follows:

A loop of small intestine is brought up, a segment of bowel twelve inches or more resected and held in forceps while an end-to-end anastomosis is made to restore the continuity of the bowel. The breach in the mesentery is closed and the isolated loop of bowel with its blood supply is prepared by removal of the forceps on the proximal end of the intestine. (It may be important to use the proximal end so that the peristaltic wave is directed away from the liver.) In order to be sure that the mucous membrane does not turn in a slit a half-inch to an inch long is made through the intestinal wall longitudinally, beginning about one-half inch from the cut proximal end. A forceps passes through this slit and seizes the edge of the intestine and draws it through the slit, thus inverting the end. The distal clamp is removed and a strip of gauze is drawn through the segment of intestine to cleanse it. A rubber tube, with an extra opening in the side, is passed through the loop of bowel,

so that it goes approximately an inch beyond the end of the intestine. The tube is tacked to the intestine by catgut suture. This suture is to hold the tube for a few days. The other end of the intestine is attached to the tube in the same manner. The inverted proximal end of the intestine is now brought in contact with the proximal end of the severed duct and is held there by a linen suture, takes in a bite of the end of the duct and holds the mucous membrane in contact with it. It has not yet been determined whether it will be better to bring the bowel in front of the colon or through the mesocolon. The loop of bowel and its mesentery are tacked firmly to the parietal peritoneum and to the duodenum, where it crosses; a considerable slack, it seems, should be left above these sutures, so as to avoid possible pulling away of the intestine from the end of the duct. A large fold of omentum is brought to the field of operation and carefully fitted over the end of the intestine and its junction with the bile duct. It should be tacked as well as possible to the surrounding peritoneum. A protective quarantine pack is placed so that drainage from under the edges of the omentum will take place. The tube drains the immediate field of operation. The distal end of the intestine with the end of the rubber tube is drawn out through a stab wound at some distance from the operation wound. It is held there by a safety-pin, which passes through the skin, the intestine and the tube. This causes drainage of the immediate field of operation back of the peritoneum, the intestine itself, also the tube which passes through it. The pack drains the field of operation outside the omentum, thus making an operation which combines exactly the same principle as the first case reported in this paper. After a biliary fistula has been established through the segment of the intestines it will be a very simple matter to do another operation and connect this intestinal loop to the bowel at some convenient point. This operation for this purpose involves no principle which has not been amply demonstrated under the conditions discussed earlier in this paper.

I therefore feel that this principle of indirection will, when properly applied, solve this vexatious question of reconstruction of the common bile duct.

MY OBSERVATION OF THE CARREL-DAKIN TREATMENT OF INFECTED WOUNDS

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Early in the winter of 1914 it was recognized by all the surgeons working with the wounded soldiers that a grave problem confronted them in the treatment of the infected war wounds. At this time Dr. Alexis Carrel and Dr. H. D. Dakin, working in the hospital at Compiègne, began searching for a new method of treating infected wounds. To Dr. Dakin is due the credit for the solution, as it was to his untiring zeal in experimenting with over 200 substances that he finally gave us neutral sodium hypochlorite solution. To Dr. Alexis Carrel we owe the technic of the application of the solution. Dakin's hypochlorite of soda is a solution of sodium hypochlorite (no O.C.C.), which contains not less than 0.45 per cent. nor more than 0.50 per cent. sodium hypochlorite, and which is not alkalin to powdered phenolphthalein but is alkalin to alcoholic solution of phenolphthalein. If the solution is alkalin to powdered phenolphthalein the solution is irritating, if the solution is not alkalin to alcoholic solution of phenolphthalein the solution is unstable. By whatever method this solution is prepared, if it conforms to the above formula the solution will be efficient. Any careful laboratory man can make the solution, as its manufacture is simple.

The solution is powerfully bactericidal and is proteolytic, does not harm the tissues and is not irritating except to the skin, and then very slightly so, and only after prolonged use.

Its germicidal powers are so great that no attempt is made to sterilize any vessel that is used in the preparation of the solution, and the water is never sterilized, as the solution is always sterile when the solution has the correct concentration. It is quickly germicidal even when mixed with one-half to one-third its volume of pus. It is non-toxic except when injected into the general circulation, then it is very dangerous, as it is strongly hemolytic. It quickly dissolves and disintegrates pus and necrotic soft tissue. This is a very valuable property, as it liquefies secretions and allows the solution to come in direct contact with the microörganism. The effective bactericidal action of Dakin's solution is very transient, lasting but a few minutes; but following this flash of destruction to bacterial life a substance is formed belonging to the chloramine group that has some antiseptic powers. The sterilization of infected wounds by Dakin's solution is due to two properties of the solution: its bactericidal powers and to its proteolytic property. The property to dissolve and liquefy pus and necrotic soft tissues marks the great difference between this germicide and practically all others. Dr. Carrel has well said: "The mere application of an energetic antiseptic substance by any form of technic whatsoever cannot be relied upon to sterilize a wound. The success of the method which enables us to render aseptic an infected wound is not due to the marvellous properties of a new drug. It should rather be attributed to a combination of means which enables us to make use of a definite antiseptic substance under such conditions of concentration and duration that its action becomes efficacious. This method is a combination of which each single part is essential to the rest."

All wounds to which Dakin's solution is to be applied should first be prepared mechanically. The wounds must be thoroughly exposed, debris removed, all necrotic tissue removed, all tissue likely to become necrotic removed, get complete hemostasis, then cleanse the wound with neutral soap. The instillation tubes are so applied that all parts of the wound receive the solution at the same time and in the same quantities. Contaminated but not infected wounds treated by this method

should become sterile by the sixth day, so that delayed primary suture could be done. Frankly infected wounds are sterilized in from seven to twenty-one days ordinarily when all the details of mechanical cleansing have been rigidly carried out and then the wound sutured. The wound ordinarily is judged sterile when smears taken from the deepest recesses, from necrotic-looking areas, from exposed bony surfaces do not contain more than one microörganism to five microscopic fields on two successive days. At times it is necessary to make cultures before determining a wound sterile. The macroscopic appearance of the wound cannot be depended upon to say whether the wound is sterile or not.

Practically all war and accident wounds of civil life are contaminated wounds and will become infected wounds within twelve to forty-eight hours if they are not closed. It is rarely possible to demonstrate microörganisms by smears in a contaminated wound, but twelve to twenty-four hours later the same wound will yield an abundant crop of bacteria under every microscopic field. When contaminated wounds can be properly cleansed mechanically and can be closed primarily we do not think that the instillation of the Dakin solution is indicated. Infected wounds of not more than forty-eight hours' duration, when a thorough debridement can be done, where the virulency of infection is not great, the general resistance of the patient normal and the blood supply good, we found did well with no other antiseptic than ether, and that these wounds could be closed by delayed primary, but are never to be closed primarily unless constantly under the care of the surgeon who closed the wound. Occasionally in wounds of the knee-joint of more than twenty-four hours' duration, when extensive debridement extending into a joint was done, we closed the joint capsule completely as well as soft tissues and skin, with good results. In contaminated wounds that cannot be properly debrided, or when from great loss of tissue the wounds cannot be closed primarily or by delayed primary, or when the blood supply to the wounded part is poor or when the general resistance is not good, then the Dakin solution is a wonderful aid

to the treatment of the wound, and in infected wounds of forty-eight hours' duration or longer the Dakin solution should always be used both in war surgery and civil surgery when its application is practicable. A sterile wound not closed and not bathed in an antiseptic solution quickly becomes infected. A wound sterilized with hypochlorite solution and then dressed with vaselin soon becomes reinfected. The hypochlorite solution hastens markedly and vividly the cicatrization of wounds, but it does so through its great antiseptic powers and not in any other way. The hypochlorite solution does not hasten cicatrization after the wound has become sterile, but it does not retard cicatrization of a sterile wound. Topical applications to wounds can hasten cicatrization only so far as they destroy microörganisms, and in direct ratio, as they do destroy bacteria and do no harm to tissues, do they hasten cicatrization of wounds.

It was almost universally observed in the hospitals of the American Expeditionary Forces that patients whose infected wounds had been properly treated by the Carrel-Dakin method suffered less pain, had less systemic infection, were more alert and cheerful, had a more rapid convalescence and the wounds closed far earlier and with less deformity and less morbidity than those patients whose infected wounds were treated by other methods. It is our firm opinion, obtained from observation and work done with Dr. Carrel at Rockefeller Institute, work and observation in the base hospital in America and in the evacuation and base hospitals in France and Germany, and in work in civil life, that we have in the Carrel-Dakin method of treating infected wounds, whether civil wounds or war wounds, the most valuable contribution to the treatment of infected wounds since Lister's day.

When reviewing the criticisms of this method it is well to remember what Dr. Carrel has said: "It is indispensable to learn the method before attempting to apply it, and this apprenticeship demands several weeks even from an experienced surgeon."

DISCUSSION

Dr. Goodrich B. Rhodes, Cincinnati, Ohio.—In our early warfare we looked around to see if we could not find some universal antiseptic, and the Carrel-Dakin seemed to fill the bill at first, but it has to be used with some discretion. The technic we used in our hospital was that in every case that came in a blood culture was taken of the wound. In about 65 per cent. of the cases anaërobes were found, and these cases were immediately and thoroughly debrided. Dakin tubes were put in place, but the instillation of the Dakin solution was not started until the next day. If the wound looked at all suspicious for anaërobes clinically, quinin solution was started. If, on the next day, there were no symptoms of anaërobic poisoning the quinin was discontinued and the Dakin solution started. The Dakin solution was not started until the second day, because our experience was that with the proteolytic power of the Dakin solution all blood clots were dissolved and we were liable to have severe secondary hemorrhages from dissolving clots in the vessels. General oozing from the tissues was also caused. As to the question of anaërobic infection, we found the Dakin solution had no effect on it. The sporogenes and tetanus organisms thrived on the Dakin solution. Our experience was similar with the pyocyaneus organisms. These organisms would thrive in the Dakin solution. We got around that early by Taylor's discovery of using acetic acid. One per cent. of acetic acid will clear up the pyocyanic infection in three days, and you will have no further trouble with it.

SURGICAL DRAINAGE FROM A BIOLOGICAL VIEWPOINT

By J. Shelton Horsley, M.D.
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The biological defences of the body against disease, trauma and the wear of age are wonderful; but they are not perfect. If they were perfect, man would live forever. Particularly interesting is the manner in which the body protects itself against injurious foreign substances. The epithelial-lined body cavities have more or less specialized methods of protection. The stomach, for instance, by vomiting emits food that is spoiled, many drugs that are irritating or disagreeable to the taste, and sometimes even rejects substances that are thought to be nauseating or noxious even though they are not. The excessive salivation when nausea occurs probably tends to dilute the offensive material or to protect the walls of the mucous membrane. Vomiting undoubtedly is a habit that was acquired in the early days of evolution. The more refined drugs or poisons that are a result of chemical manufacture have not created a similar defence by the stomach and are often retained.

Foreign irritating substances in the rectum, the bladder or the larynx are also expelled by muscular action. Irritating matter in the nose causes a profuse secretion which tends to wash away the offending substance. An irritating foreign body in the eye causes at once a flow of tears in an effort to wash it away, and at the same time the spasm of the muscles of the eyelids is probably due partly to an effort to expel the foreign body as well as to protect against further injury.

In endothelial-lined cavities or in solid tissue there is an attempt to wash away foreign irritating matter. This is done by the pouring out of serum from the lymph circulation in the neighborhood of the foreign substance, which is accomplished by the reversal of the circulation in the local lymphatics so as to empty their contents around the irritating material. This is really the chief basis of all surgical drainage.

In surgical drainage mechanical measures that are followed by fortunate results would appear ridiculous if no biological conditions existed. In preventing infection of a fresh raw surface or in the so-called walling off of healthy tissue from the products of infection, gauze is often placed over the raw surface or as a coffer-dam in the abdominal cavity and an abscess is drained through the center of this gauze packing. If we could convert this into a mechanical proposition and imagine that the pus was a solution of methylene blue, and that it was flowing over this raw surface which had been covered with absorbent gauze to prevent contamination, we know that both the gauze and the wound would be deeply stained. However, this method of protection does act in a beneficial manner and a clean wound is often by this means kept from septic infection. The drainage of a peritoneal abscess is practically always up hill and is usually successful. If mechanics were the only principle, how could an appendicular abscess ever be drained by putting a tube down to it through the abdominal incision? The whole method of drainage really depends upon the reversal of the circulation in the local lymphatics and is chiefly a biological process. It is nature's effort to extrude a foreign substance[1].

A splinter in the finger which becomes mildly infected will discharge a thin seropus for days. This is nature's effort to expel the splinter. After it has been removed the wound rapidly closes and the lymph circulation, which was, in part at least, reversed in an effort to extrude the splinter, assumes

[1] The Value of Biological Principles in Surgical Practice, by J. S. Horsley, M.D., Jour. Am. Med. Asso., May 3, 1919, lxxii, pp. 1263, 1266.

its normal course and probably in twenty-four hours after the splinter has been removed there is no further discharge.

The peritoneum and its underlying structures in the abdominal cavity constitute an enormous lymph space, and the lymph is here abundantly poured out in response to an irritation. The insertion of a drainage tube causes a reaction in which there is a flow of lymph in an effort to expel the drainage tube. Drainage of the abdominal cavity prevents positive pressure in the septic region and also the drainage tube is a stimulus for a reversal of the lymphatic circulation. The packing of a fresh wound with gauze causes a similar reversal of the lymphatic circulation, and, though pus may flow over this gauze from a deeper focus, the lymphatics, instead of absorbing the pus, pour out lymph into and around the gauze to extrude it. The beneficial action of the cigarette drain, which is soon clogged with coagulated lymph, is comprehensible when we look upon it as a stimulus for reversal of the local lymphatic circulation.

In regions of the body in which the lymph supply is less abundant than it is in the abdomen, unless the infected focus is very small, it will be necessary to utilize gravity when instituting drainage, because there is not a sufficient flow of lymph to flush the septic cavity thoroughly and constantly as is the case with abdominal drainage.

Drainage in surgical operations may be classified under three heads, according to the following table:

Classification of Surgical Drainage

1. Drainage of solid tissue or endothelial-lined cavities.

(*a*) Drainge of endothelial-covered tissues of the abdominal cavity.

(*b*) Drainage of other endothelial-lined cavities, as pleura, joints.

(*c*) Drainage of solid soft tissue, as muscle, fascia, fat.

(*d*) Drainage of bone.

2. Drainage of inflammatory products from infected epi-

thelial-lined hollow viscera, as the gall-bladder, the urinary bladder.

3. Drainage of hollow viscera in order to restore function or to secure physiologic rest.

1. Drainage of Solid Tissue or Endothelial-Lined Cavities. Considering first (*a*) drainage for abdominal abscesses we find, as has already been stated, that the abdomen has an enormous supply of lymph and that the successful drainage of an abscess in this region consists (1) of relieving the pressure in the abscess cavity by opening it and inserting a drain, and (2) of inducing a sufficient reversal of the lymph circulation by the presence of the drainage material to cause much of the septic products to be washed away along the drainage track. If the drainage material reaches the abscess cavity so that the pus is not under positive pressure, and if the drainage is sufficient in amount and of the proper kind to act as a stimulus for reversal of the lymphatic circulation, so much lymph is poured out that practically a continuous irrigation is going on from the local lymphatics along the tube or track of the drainage material, and it is a matter of but little importance whether the drainage material is pointed up or down. But in other endothelial cavities (*b*), such as the pleura or the joints, where the lymphatic supply is much smaller than in the abdomen or where the configuration is such as to make the drainage difficult, gravity must aid and the problem becomes more mechanical than biological. Drainage here should be at the lowest point if possible.

Drainage carried down to the sutured bowel frequently results in a fistula, particularly if gauze in the form of a cigarette drain is employed. The reversal of the lymphatic circulation in the neighborhood of a recently sutured intestinal wound, which will direct the current of lymph to the drainage, interferes with the normal process of repair in the intestinal wound, causes a weak fibrinous deposit and diminishes the nutrition of the repairing bowel; consequently the sutures readily break down and a fistula results.

In drainage of muscle, fascia and fat (*c*) gravity drainage

must be considered, but the biological problem is also prominent. An abscess in the thigh heals better if gravity drainage is instituted. The drainage material should be sufficient not only to carry off the secretion but to excite the local lymphatics to reverse their circulation. The local lymphatics, being much less abundant than in the abdomen, cannot usually furnish enough lymph to cause the flushing out of the septic products as occurs in the abdomen. In rapidly spreading inflammation wide incisions and drainage are useful in relieving the pressure that is made by the binding fascia or skin, and in reversing the circulation of lymphatics and so preventing absorption of much of the septic products into the main lymphatic trunks.

The old operation of "fence-rail" incisions along the margin of an advancing erysipelas causes the pouring out of lymph from these cuts and the diversion of the lymph current which would otherwise carry the septic products to further uninfected regions. The undermining of the skin and insertion of tubes or gauze drainage from point to point make the pouring out of lymph along the drainage material even greater than after a simple incision.

That the reversal of the circulation is the chief biological process, by which surgical drainage acts beneficially in solid soft tissue, can also be recognized when there is a small abscess in a large amount of inflammatory exudate, and it is impossible to locate the small abscess cavity. If a drain is placed in the immediate neighborhood of the abscess it frequently opens into the drain. It seems probable that this occurs because the lymphatic current attempts to extrude the drain and so the products of the abscess are carried in this direction and the abscess burrows to the tube.

The drainage of tissues whose lymphatic trunks have been clogged, and where, consequently, edema is present, depends upon an effort to increase the lymphatic circulation or to create new lymphatic connections. In the operation of Handley, in which long threads of silk are placed under the skin in edema of the arm, lymphatic channels form along the threads. In the operation of Kondoleon the deep fascia of the arm or leg

is split in order to promote an anastomosis between the deep and the superficial sets of lymphatics and so to divert the lymph current from the superficial to the deep lymphatic trunks.

Local edemas that are persistent are usually caused by blockage of the lymphatic channels and not by interference with the blood circulation. The edema that sometimes appears in the arm after a radical operation for cancer of the breast in which the axilla is thoroughly dissected is due to the removal of the lymphatics. If this immediately follows operation it may disappear when the collateral lymphatic circulation is established, but when a late edema results it is frequently because the lymphatics have become plugged with cancer cells and such an edema is ominous. Resection of the axillary vein, if the lymphatics are in satisfactory condition, is followed by but little if any swelling in the arm and that of a temporary nature. A phlebitis causes edema only when the lymphatics around the vein are involved in the inflammation.

Drainage of wounds after radical operations for carcinoma in solid soft tissue should always be done. This is not so much in order to carry off the fluids that may accumulate in the wound as an effort to reverse the circulation of the lymphatics which may be induced to pour out their contents in the direction of the drainage tube and so to discharge through this drainage cancer cells that have been left in the wound or that may have lodged in the open lymphatics. This is an important step in many radical operations for cancer, as after operations in the neck or on the mammary gland.

Drainage of bone (*d*) involves problems of a somewhat different nature because of the structure of bone. Bone is compact, rigid tissue in which lime salts are arranged in an orderly way. On account of the rigid structure it is impossible for either the bloodvessels or the lymphatics to form, or for the lymph current to reverse, as readily as in soft tissue. Before drainage can be accomplished or any effective stand against infection can be made the lime salts must be removed, so converting bone into what is practically soft tissue. For this

reason in areas of inflammation bone is always soft. Around an irritating substance in bone, whether accompanied by infection or not, lime salts are absorbed. When this is accomplished the offending material becomes loose and is prepared for extrusion. If, for instance, a piece of iron, as a screw used in plating bone, is inserted into a bone the lime salts in the neighborhood of the screw and of the plate are absorbed. The screws which may have been very tight and firm when inserted gradually become loose. This induced osteoporosis around the screws, and the metal plate is just the reverse of what is desired when a fracture is to be repaired and accounts for the frequency of non-union after plating bones.

The numerous so-called abscesses at the roots of teeth are probably often the result of the reaction of the bone in the neighborhood to some material that was used in filling the cavities in the roots of the teeth. Undoubtedly apical abscesses frequently occur, but it is probably equally true that an osteoporosis sometimes interpreted as an apical abscess may be sterile and due to the reaction of the bone to the material with which the root of the tooth has been filled.

Because of the poor lymphatic supply of bone and its rigid walls which protect its vessels a bone abscess may be more readily disinfected by means of strong antiseptics, such as carbolic acid, than if the abscess were in soft tissue. Here as disinfection can be more thorough the necessity for full drainage in the milder chronic infections of the bone is not so great if the diseased bone has been removed as would be in soft tissue. Consequently, "fillings" or "bone plugs" are utilized.

2. Drainage of Inflammatory Products from Infected Epithelial-Lined Hollow Viscera, as the Gall-Bladder or the Urinary Bladder.—Drainage here involves principles different from the drainage of an abscess that has formed in solid tissue. This drainage is not only for removing the products of infection but serves a double purpose of also giving physiological rest to the infected organ. The drainage of a septic gall-bladder that may be filled with pus carries off the products of the bacteria and at the same time gives rest to the

gall-bladder by preventing distention, and this removes both a stimulus for contraction and the tension that would occur on the distended walls. Drainage of this type does not have to be gravity drainage. If a sufficient opening is provided in the general axis of the peristaltic current, it is all that is necessary. In draining an infected urinary bladder, for instance, an opening made at the top of the bladder is as satisfactory in securing results as an opening at the bottom.

When these hollow muscular organs are contracted a small opening will ensure the viscera keeping empty if it is made in due regard to the action of peristalsis. Even in such instances, however, the beneficial action of the drainage is not solely removal of the contents of the hollow viscera or giving physiological rest. It seems highly probable that reversal of the lymphatic current is also of importance here. This appears to be borne out by the results of drainage of the bile tracts in inflammation of the pancreas. It is well known that chronic pancreatitis can best be treated by prolonged drainage of the bile tracts and drainage of the common bile duct for this affection seems to be particularly effective.

The work of Deaver and Pfeiffer on pancreatic and peripancreatic lymphangitis[1] is interesting in this connection. They call attention to the anatomy of the lymphatic supply of the pancreas and its ultimate connection with the lymphatics of the bile tracts and gall-bladder. They say: "To the objection that infection to be carried into the pancreas must stem the efferent lymph current and force the valves the answer can be made that everyone has seen infection in cellular tissues proceeding in a reverse direction to the lymph current. Thrombolymphangitis readily diverts the normal lymph course and infection easily destroys valves. The force of pathology here, as in so many other instances, perverted the normal function." If infection of the pancreas can be through the lymphatic supply from the gall-bladder or the gall-tracts, as Deaver and Pfeiffer assert, it seems that the method of relieving this infec-

[1] Pancreatic and Peripancreatic Lymphangitis, by John B. Deaver and D. B. Pfeiffer, Annals of Surgery, 1913, vol. lviii, pp. 151 to 163.

tion is to reverse the lymphatic current and cause it to be diverted toward the drainage tube and the incision in the gall-bladder or in the common duct, just as the lymph flow is reversed in the drainage of an abdominal abscess. Septic products that would be carried in the lymphatics from the infected gall-bladder to the pancreas are thus diverted to the drainage tube in an effort to extrude it. If this diversion can be maintained sufficiently long until nature can build up the resistance of the pancreas to the infection and repair the damage already done, the patient may be considered cured. But if the drainage tube is removed too soon, there is no further stimulus for a reversal of the lymph circulation and the pancreatitis recurs.

Too early resumption of function after drainage of inflamed hollow viscera frequently results in a recurrence of the inflammation. This may be due to one of three causes, or more probably to a combination of these causes. (a) There may be an accumulation of secretion that is not free from the products of the inflammatory process. (b) There is an interruption of physiologic rest. (c) There is a change in the lymph current from that which had been instituted by the drainage.

3. Drainage of Hollow Viscera for Physiologic Rest. In enterostomy, the operation may be done to sidetrack the normal contents of the hollow viscera and so to afford less work for the diseased tissue below the point of opening, as in colostomy for disease of the large bowel farther down. Drainage may be instituted to prevent distention of a hollow viscus and so induce rest in order that an operative wound may heal. This principle is put into practice in such operations upon the bladder as for vesicovaginal fistula when a self-retaining catheter is placed in the urethra, and in the introduction of a tube through the rectum and through the site of resection of the sigmoid or left colon in order to draw off the gas and prevent distention in the region of the operation. This principle of drainage is often utilized after removing stones from an uninfected gall-bladder.

Drainage Material. The material for drainage must be considered not only with regard to transporting the products

that are to be drained, but with regard to the biological influence of the drain upon the local lymphatics. Certain substances call for a more pronounced flow of lymph than others. Rubber, for instance, is not so irritating to tissue as gauze. When gauze is placed over a raw surface the local lymphatics pour into the gauze quantities of lymph. This is nature's effort to extrude an irritating foreign substance. When the lymph has coagulated the meshes of the gauze become entangled with the wound and an effort to remove the gauze before this fibrin has softened results in tearing the delicate tissues of the wound and injuring its granulations, causing bleeding. An ideal drainage material would be one which, on the one hand, is a pronounced stimulus for the lymph to be poured out along the drain, and, on the other hand, would not be sufficiently attached to the raw surface of the wound to injure it. This material has not yet been found.

Rubber drainage tubes are frequently used and have the advantage of draining off inflammatory products readily, but do not provoke such an outpouring of lymph as gauze would. Naturally, however, the larger the tube the greater the irritation and the more pronounced the stimulus for a reversal of the circulation of the local lymphatics. Consequently, for draining an abdominal abscess it is often found that a large tube does better than a smaller one, not because the smaller one is insufficient to carry off the serum or the pus, but because the small tube is not large enough to provoke a sufficient amount of reaction among the local lymphatics. Frequently the advantages of both gauze and rubber are combined by placing a gauze strip inside of the tube or by wrapping strips of gauze in rubber tissue or rubber dam, which is called a "cigarette drain," and using this in addition to a tube. In this way the gauze, which is exposed at the end of the cigarette drain, causes a more pronounced flow of lymph than the rubber tube alone could produce, and the tube drains away the lymph that is thrown out to extrude the gauze and the tube. Drainage material should not remain too long in a wound, else it will act as the infected splinter mentioned above.

Combinations that are effective have been worked out to a large extent empirically. Sometimes strands of catgut, silkworm gut, or strips of rubber tissue are inserted into a wound in which it is anticipated that there may be a collection of serum or broken-down fat on account of the nature of the wound. This foreign substance, the drainage material, directs the current of the lymphatic flow toward itself and so prevents an accumulation in the tissues which might later become a culture medium for bacteria. An opened superficial abscess often needs no drainage material, for the necrotic products of the inflammatory process are a stimulus for drainage.

Encapsulated Foreign Bodies in the Peritoneum. If such foreign materials as gauze or cork are left in the abdominal cavity under sterile conditions they are rapidly surrounded by a deposit of fibrin, as shown by Hertzler[1]. This fibrin, which is coagulated lymph, soon is covered with endothelium and takes on the characteristics of peritoneum. If the gauze is left for a number of weeks or months it may intrude into a neighboring hollow viscus and be expelled, as this may be the point of least resistance, and, consequently, of greatest pressure. Instances are recorded in which gauze that has been accidentally left after a surgical operation has been expelled by the bowel or by the bladder months or years later. Sometimes, however, the gauze is completely encapsulated with a cyst-like wall and becomes so thoroughly infiltrated with fibrin that partial organization takes place. Portions of the gauze may be disintegrated and removed by phagocytes, and the connective tissue penetrating the rest of the gauze is so intimate that it may have to be dissected away with much difficulty.

[1] The Peritoneum, by A. E. Hertzler, vol. i, pp. 251–253, published by Mosby, 1919.

DISCUSSION

Dr. Thomas S. Cullen, Baltimore, Md.—I have enjoyed Dr. Horsley's paper very much, but did not listen to it with the intention of discussing it. I have not studied the subject from an experimental standpoint, but have been deeply interested in so arranging my abdominal drains that we might get the maximum drainage in the minimum length of time. As a result of this close observation I have been able to reduce the sojourn of the patient in the hospital on an average several days.

I had hoped that in the discussion this morning something might be said about the postural drainage used by Roland Hill, by our presiding officer, Willard Bartlett, and by others in St. Louis. In general peritonitis cases resulting from a ruptured appendix they have the patient lying face down, the shoulders are raised on pillows and the body so adjusted that the right iliac fossa is the most dependent part, and the discharge literally pours out of the opening at this point for the first few hours following operation. When listening to Dr. Horsley's paper I was trying to figure out whether there was really a reversal of the lymph flow or whether the large amount of serum escaping was not due merely to the cutting of the lymph channels of the parts. The paper of Dr. Horsley is a most constructive one, and I only wish that I were familiar enough with the subject to discuss it adequately.

Dr. Joseph Ransohoff, Cincinnati, Ohio.—I have been very much interested in this paper because its author has presented the subject of drainage in a very scientific way. I cannot exactly understand the fact that there is a reversal of the lymph whenever drainage is used. I rather believe with the previous speaker (Dr. Cullen) that a good deal of it is the result of cutting of the lymphatics.

The manner in which the essayist classifies the various forms of drainage, according to the character of lining of the wound, if I may use the word in this connection, certainly is to me a rather new way of looking at drainage. I agree with him fully that the best drain we can have is the rubber drain with the gauze within. There is a certain amount of oozing from gauze

drainage within the rubber tube. We know very well that gauze tissue in the course of time is disintegrated if allowed to remain long in the wound. We had a most interesting case of that kind just before the outbreak of the war. Quite a prominent man was operated by my son for an acute appendix. The patient was not doing well. The drainage continued and continued, and various vaccines were made by our own bacteriologist and used without result. Our bacteriologist, a man of international reputation, took some of the discharge and made a vaccine, which was used but did not do any good. When I looked at the wound I saw something like vermicelli sticking in the wound, and a bit of the drainage gauze had been disintegrated, had been sterilized too much and no edge put upon it, and that was pulled out just as a tendon that has sloughed will be pulled out of an old-fashioned felon; from that moment the autogenous vaccine effected a cure.

Dr. James E. Thompson, Galveston, Texas.—I have listened to Dr. Horsley's paper with a great deal of interest. It is a very philosophical paper, and I have only one criticism to make as to his conclusions. This is in the direction of their interpretation. There is no doubt that after we have opened an abscess cavity and relieved tension there is a reversal of the lymphatic current. This reversal occurs even in the absence of a drainage tube. Before tension is relieved the flow of all the serum is from the abscess cavity through the granulation tissue into the vessels of the patient; in other words, it is centrifugal, considering the abscess cavity as a center. It has occurred to me that this question of reversal of the flow of fluids is one of pure mechanics. We know it is only temporary, and that as soon as the walls of the abscess cavity become applied to one another it ceases. This is exemplified by any abscess occupying the peritoneal cavity. Such a cavity will drain for a few hours or maybe a day or two. As soon as the walls come into contact drainage ceases. I do not believe that the drainage tube exercises any specific effect on the granulation tissue except that of irritation.

Dr. Joseph A. Danna, New Orleans, Louisiana.—I feel rather timid about getting up before such a learned assemblage and discussing theoretic problems such as this. I am in the habit, in the course of my talks to our students, during the pro-

cess of closing an operative wound, and especially to impress them with the need of avoiding the leaving behind of dead spaces and undrained fluids, of telling them the story of the fox and the ducks.

The story goes that the ducks were swimming in the stream and the fox was anxious to get to them. As long as the ducks were away from shore the fox could not reach them, and the way he finally succeeded was by climbing on a log farther up stream and floating down the river unobserved.

The example works out in this way: We know that the normal healthy fixed tissue cells will take care of any small amount of bacterial contamination. We know if we float bacteria in a lake of serum or blood, or in a mass of traumatized or dead tissue, and these fixed tissue cells cannot get to them, we have infection. That is why we try to avoid dead spaces in closing a wound. This works still further, in my opinion, in explaining how the incision of an abscess and the placing of a drain stops infection and cures the abscess. What happens? The only thing you do by incision and drainage is to permit that lake in which the ducks (infecting bacteria) are floating to be drained. They are landed high and dry, and your fox (the fixed tissue cells) now has a chance to get at them. In order to further heal that abscess, however, you have got to permit the walls of the cavity once more to come together. Take a wound of the thigh or anywhere else, and, if besides drainage you do not have collapsing of the walls of the abscess, you will not get healing. Why do you not get healing sometimes in empyema cases? Because you drain only. You have drained perfectly, but your walls have not come together, and if you wait long enough, granulation tissue formation continuous to the point of forming resisting inelastic walls, that will require a special operation to effect a cure. You cannot heal a bone abscess unless you have soft tissue to fill in the gap. The Carrel-Dakin method has proved wonders in the healing of processes we could not heal before, because it does what the fox cannot do. The Carrel-Dakin method is a fox which is able to swim and get out in the lake and get the ducks. In that way infection can be cured in spite of the fact that you have extensive cavities, and when the bacterial infection has been overcome, you do secondary operations in which you forcibly bring the walls of the cavity together.

Dr. W. A. Bryan, Nashville, Tennessee.—An inflammatory process is not, as we ordinarily look at it, a disease but a reaction, and I think whenever we fail to look at it in that way, we fail to grasp the meaning of inflammation. There is no difference between an inflammatory process up to a certain point in healing and an inflammatory process resulting from infection.

Dr. Horsley has written a beautiful paper, and his idea, if I understood him correctly, is well illustrated in the difference between our old treatment of suppurative peritonitis and the new treatment of it. When I began to practice medicine, in 1899, I lost a good many of these cases, and I found out that others were losing a great many of them. I read a report not long ago by a practical man, who is one of the competent surgeons in the South, who said that before we changed our tactics we were losing from 25 to 40 per cent., and even 80 per cent., of these cases. We washed these cases out. We had the idea that if soap and water was good for dirty linen the same principle could be applied to a dirty peritoneum by washing it, and we lost the majority of our cases. Later on we decided nature could do something for these cases. Dr. John B. Murphy said, "Let us get out the appendix and nothing else, put in a drainage tube, and let the patient alone, and he will get well."

In the last issue of the *British Surgical Journal* I was very much astonished at a statement that was made. We have the idea that pus is made up chiefly of serum and dead leukocytes. This man in this article claims, and I believe justly, that if we will take fresh pus from almost any kind of acute abscess, put it on a slide and lay that slide on a Petri dish, covered with a culture of ordinary pyogenic bacteria, immediately the pus destroys almost the whole field lying under the glass. If that is the case the phagocytes in the pus that are inimical to the life of man are capable of taking care of the bacteria contained in that pus. When the tissues get well, what do they do? Nature brings to bear certain things. In addition to what is already present in the process of healing, these bacteria are the fighters. If I could turn Dr. Danna's argument around I would make the ducks chase the fox. I want to get the ducks after the fox. The fox is playing the devil, the bacteria present are playing the devil and liberating poisons, and these poisons not only consume the antibodies in the healing powers in the tissues and cells of fluid,

but they are in the way and prevent new ones from coming. When you drain, it is immaterial whether you get a reversal of the lymphatic current or not. The fact remains now that, with the drainage of poisons, you let out a certain amount of toxic material; you let out a certain number of bacteria, which counts for little beyond lessening the tendency toward the reëstablishment of a correct circulation. When you do that you bring more antibodies, you bring more serum and lymph, you bring a greater opsonic power into the field, you bring more leukocytes, and you bring more ducks in to kill the fox. That is the idea.

Dr. Alexander Primrose, Toronto, Ontario (by invitation). —I did not expect to be called upon to discuss this paper, but the question which Dr. Horsley has brought up is one in which I am very much interested, and I have enjoyed his very instructive paper. It is probable that Dr. Horsley's intention was to emphasize the biological factor only, in connection with surgical drainage; nevertheless, various processes are so interrelated that I think we must view the subject as a whole.

I think we may speak of three different factors in the drainage of a wound. First of all, the biological factor, in which, I think, Dr. Horsley will agree, we have not only an outpouring of lymph but a local leukocytosis and a phagocytosis which has been referred to by other speakers. In fact, I would interpret some of the phenomena of which Dr. Horsley spoke as being due to that rather than to lymph outflow. The far-reaching effect of these factors is illustrated by studying the effect of painting the skin surface with iodin. Investigation has shown that it was not so much the bactericidal effect of iodin which is effective, but the fact that it has a peculiar tendency to penetrate tissues and to create a local leukocytosis which is protective.

In addition to the biological effects, however, we must remember we have next in order drainage material. There I quite agree with Dr. Horsley that we have not yet discovered an ideal material. Certain criticisms which were long ago directed against the drainage tube still hold, in that we must look upon the drainage tube as often the indirect cause of the pus which flows through it. This fact was demonstrated in the recent war more than ever before. The fact also that it is often safer to omit drainage was amply demonstrated. During the

war we found it possible to do this in many cases where formerly we never thought it possible. Infected knee-joints, for example, were cleansed and closed up without drainage, with excellent results. Many infected wounds were thus successfully treated. In many instances the pleural cavity was successfully aspirated without drainage even when we found certain pathogenic organisms present. The mere aspirations of such chests has, in many instances, proved efficient without establishing drainage.

I would like lastly to refer, as a third factor, to the physics of a surgical dressing. I think it is most important, and I am much surprised that more attention has not been paid to it. If you had had the experience I have had in regard to the placing of materials impermeable to air over dressings you would the better appreciate my point. The British, early in the war, widely adopted, almost as routine, a method of placing a piece of material called jackonette over all their dressings. Jackonette is something like oiled silk, and is quite as impervious to air. We had at Salonica patients coming from the front with frost-bites, and over each dressing was a piece of jackonette, which prevented evaporation and encouraged spreading inflammation beneath. It was my habit to instruct the Sister to take off the dressing and reapply a similar moist dressing but with the jackonette omitted. Without further change in treatment these conditions cleared up.

The physical laws operative in such a dressing may be demonstrated by a very simple experiment. Take a flask, fill it half-full with water, then place a wick with one end in the water and the other end projecting as a tuft from the mouth of the flask. Now put a piece of anilin dye in the wick near the neck of the flask. The tuft which projects beyond the flask will become colored as the dye spreads and the water evaporates. If you then adopt the simple expedient of putting a bell-jar over the flask you will find that instead of the coloring matter spreading into the projecting tuft there is a tendency for the color to spread down into the flask. This experiment illustrates the fact that you must not only have the proper type of drainage, but in addition you must have dressings of such a character as to allow free absorption into the dressing and free evaporation from its surface.

Dr. Willard Bartlett, St. Louis, Missouri.—I fancy what Dr. Cullen refers to is the result of some of us turning our patients on the abdomen immediately after an operation, and where the peritoneal cavity has had a great deal of fluid in it, to let it run down hill, mechanically emptying the peritoneal cavity. The thing works out all right as long as the patient is under the influence of an anesthetic, but one finds so very few individuals who are accustomed to lying or sleeping on the face. There are very few individuals who are sufficiently comfortable on the face for this position to be maintained long. Furthermore, I doubt whether it is of any value after perhaps an hour or two; but certainly it does empty the patient. I refer to the fact that drainage cases are closed off early in the peritoneal cavity. Our patients have done well that day, no matter how they were treated by other methods. I do not think it has as great a value as we originally thought it had, especially in view of the fact we now know that intra-abdominal tension is not a matter of mere mechanics but a physiological affair.

The history of putting patients on their faces is interesting. It occurred to me independently of others who had done this at the same time or earlier, as a result of a sort of building-up process.

Dr. W. R. Jackson, Mobile, Alabama.—I enjoyed Dr. Horsley's paper very much. It is philosophical and logical and scientific. There was one thing that was new to me in the paper, namely, the reversal of the lymph current. Taking any kind of wound, suppose the lymphatic channels were cut in continuity, we have a reversal there on one side and a regular current on the other. In other words, if lymph flows into the cavity of the abscess we have a lymph current in one direction normally and a reverse current in the other. We have a reverse current after the lymphatic trunks are injured. We know that whenever any irritation of tissue takes place, whether bacterial, traumatic, mechanical or chemical, hyperemia takes place in that tissue. Suppose it is an abscess. The abscess wall is full of leukocytes, fibroblasts and so on. When we make an incision to relieve the tension we produce negative pressure in the abscess cavity. What is the result? Hyperemia of the abscess wall takes place; hyperemia of the new angiomatous tissue; new bloodvessels

become congested in the wall of the abscess. A rupture occurs very often; that gives us primary wound secretion. We have a hemorrhage in the early abscessed cavities as soon as tension is relieved. Suppose it is a wound with not much inflammatory condition, and it is potentially an infection, you put in drainage for two reasons—to drain the primary wound and to decrease the culture media and carry it off. This serum we call "wound secretion" is not pure *lymph*. It is serum from bloodvessels, serum from osmosis by the fluid passing out of the stomata in the walls of the vessels, by reaction due to negative pressure. We wish to drain to prevent the culture media, not so much to carry the leukocytic load of bacteria, but to provide a channel for subsequent infection, if it should happen. As Dr. Primrose says, if the drainage tube is too large it produces pus that it is intended to drain off, inasmuch as it carries in more virulent infection than was already present in the primary wound. Nevertheless, in draining for the removal of pus I believe the larger the surface of drainage material the greater the drainage.

Dr. Horsley (closing the discussion).—Considering the remarks made by Dr. Primrose in regard to the leukocyte count, I did not attempt to take up every feature of inflammation and drainage, because volumes could be written on that. What has impressed me is the fact that a general surgeon will open an appendicular abscess on its roof, place a drainage tube down to it and the patient will get well. But if there is pus in the thigh, for instance, incision is made and a drainage tube inserted at the lowest point. Both cases recover. If you drain infected tissue there is leukocytosis along with the reversal of the lymphatic current; but it is caused by the inflammation, not the drainage, which probably indirectly lessens leukocytosis. If you put a tube in the peritoneal cavity, what happens? Much serum exudes. The serum comes from lymph channels or spaces. As soon as serum gets out of the bloodvessels without red cells it is called lymph. The current of the serum or lymph that comes through the drainage tube has been reversed while it was not going through the natural channel. When the lymphatic channels are cut the distal end empties, the lymph is poured out in an abnormal direction, the circulation in the proximal end probably reverses completely. This seems to justify the term

"reversal of the lymphatic circulation." Reversal of the lymphatic circulation is often seen when the main lymph channels are blocked by inflammatory products or cancer cells. As to drainage in boils in which no tube is inserted, the necrotic products and sloughs, resulting from the inflammation, act as foreign bodies and induce reversal of the lymphatie circulation.

OXYCEPHALY: REPORT OF TWO CASES WITH DECOMPRESSION OPERATION IN ONE

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The various types of cranial deformity associated with optic atrophy have been fairly familiar to the ophthalmologist for a number of years, but if I may judge from my own experience and from the comparatively meager literature on the subject the general physician and surgeon are poorly acquainted with this group of cases to which Bertolotti applies the term "craniosynostose pathologique."

Of these deformities the most frequent and important is the oxycephalic type, also called by various other names: Steeple or tower head, turmschädel, spitz-kopf, turricephaly, acrocephaly, hypsicephaly, etc. The two names which have been used most frequently and interchangeably are "turmschädel," or steeple head, and oxycephaly, and Sharpe has suggested that we consider the two names as applying to one condition which differs only in the degree of the deformity—turmschädel or steeple head for the mild form of the condition, in which there is no definite prominence or protrusion at the anterior fontanelle, and oxycephaly for the more severe cases with a prominence at the anterior fontanelle.

The first case of this character was described by von Graefe in 1866, and since that time a good many cases have been reported in the ophthalmological journals. Unfortunately the first and most important symptom is usually the progressive loss of sight on account of which the patient is sooner or later,

usually later, taken to the oculist and generally little or no attention has been paid to the cranial deformity. Since the dimming of vision usually occurs in early childhood it is often not recognized until the optic atrophy is far advanced, therefore I think it is a pity that the family physician and children's doctor are not more familiar with the fact that certain types of cranial deformity are liable to be associated with optic atrophy, as I believe that if roentgen-ray pictures were made of these pathological varieties of skull deformity in early life a diagnosis could be made in many cases and optic atrophy prevented by an early decompression to relieve the increased intracranial pressure. The importance of oxycephaly as a cause of blindness is shown by the fact that Meltzer was able to report twenty cases of this character from one institution for the blind in Germany.

Etiology. Many theories have been advanced to account for the cranial deformity and the associated disturbance of the optic nerve. As regards the cranial deformity it is now generally believed to be due to a premature synostosis of the parietal bones with the occipital and temporal bones with a compensatory enlargement in the region of the sagittal suture and in the frontal region. The cause of this premature synostosis is not known. It has been attributed by some to rickets, but most of the cases have shown no other signs of rickets—no rosary, no enlargement of the epiphyses, no curvatures of the long bones, etc.; moreover, in rickets the closure of the sutures is usually delayed and the deformity of the head is different. Of the forty cases in the collective reviews of Enslin and Patry none showed any signs of rickets. Others believe the synostosis is due to irritation of the sutures by a meningitis involving the dura, but there seems to be little to support this theory. Virchow thought that a congested condition of the skull contents without actual inflammation might cause synostosis. Schüller is of the opinion that the premature synostosis is an evidence of a developmental disturbance which shows itself in the skull and not in the rest of the skeleton, but this theory still leaves us ignorant of the primary cause. In one of my cases two

years after a bilateral subtemporal decompression the roentgen-ray shows practically complete ossification over the protruding brain, and I have wondered whether the tendency to new bone formation might be of any significance in this connection.

The optic atrophy has been ascribed to meningitis, to local changes in the optic foramina making pressure on the optic nerves and to the increased intracranial pressure. Meningitis can probably be dismissed with few words, since if it were the cause the other cranial nerves would be more frequently involved. Pressure on the nerves in the region of the optic foramina has been attributed to narrowing of the foramina by distortion or by hyperostosis, but in only one or two cases has autopsy shown any evidence of such narrowing. A few years ago von Behr claimed to have found that in many cases of oxycephaly the distortion of the skull displaces the carotid sulcus forward in such a way that the carotid artery does not lie to the outer side of the nerve but beneath it, and as the artery turns backward in its sagittal course it forms the lower wall of the optic canal, thus compressing the nerve and causing the atrophy. In 1913 Schloffer examined a number of oxycephalic skulls and in many found relations apparently confirming Behr's theory. After practising the operation on the cadaver he removed the roof of the optic canal by a two-stage operation in two cases of oxycephaly with rather advanced optic atrophy, the operation being confined to one side in each case. In one case which was followed only a few weeks there was no change in the eye, but in the other case after three weeks light perception returned, a result which had not been accomplished by a previous decompression. He says that further experience only will show whether this operation, which he calls the "Kanal operation," is valuable, but he thinks it may at least be justifiable when a previous decompression has failed.

A number of cases have been reported in which a definite condition of choked disk has been seen preceding the optic atrophy and most authors believe that the optic nerve changes are due to an increased intracranial pressure just as they are in cases of cerebral tumor. There has been some difference of

Fig. 1.—Case I. Note very tall, narrow head. Exophthalmos.

Fig. 2.—Case I. Lateral view. Protrusion at bregma. Relatively short face.

FIG. 3.—Case I. Anterior-posterior skiagram. Note thin skull and "digital impressions."

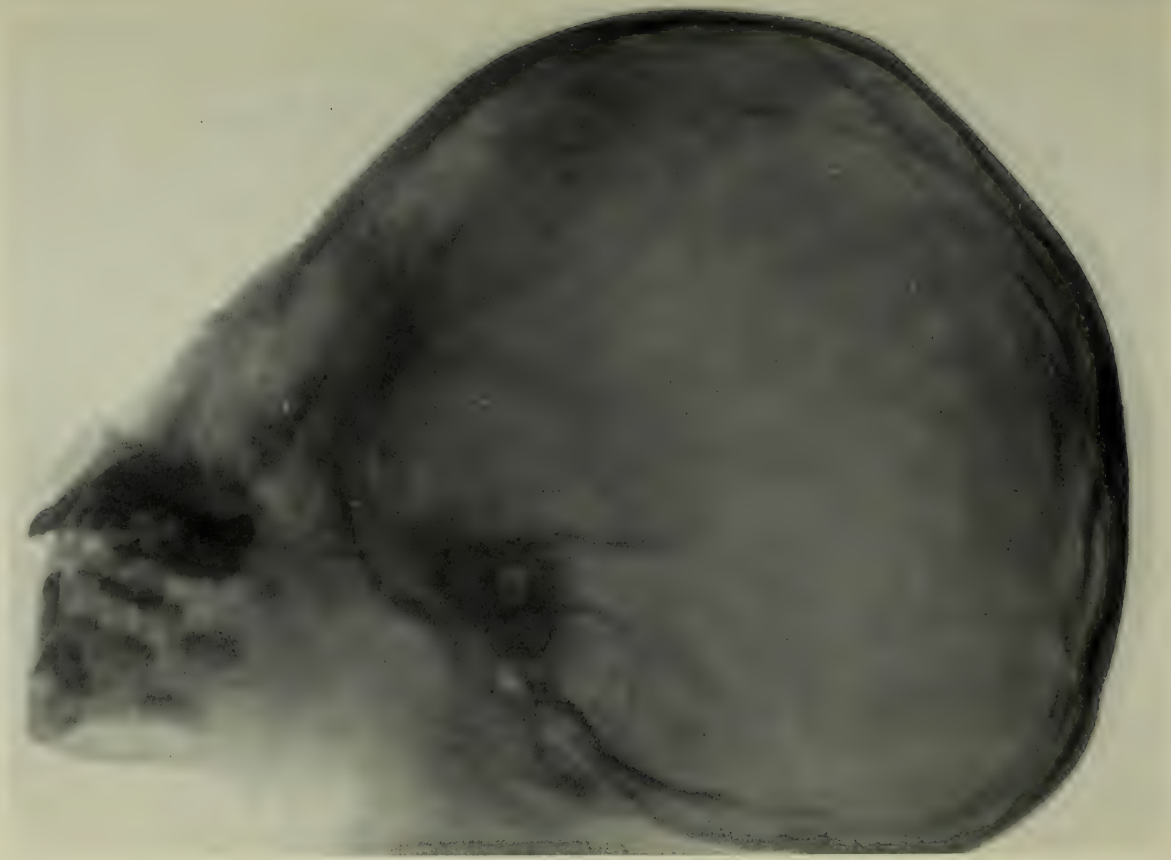

FIG. 4.—Case I. Lateral skiagram. Note deep middle fossa, shallow orbits and obliteration of mastoid and frontal sinuses.

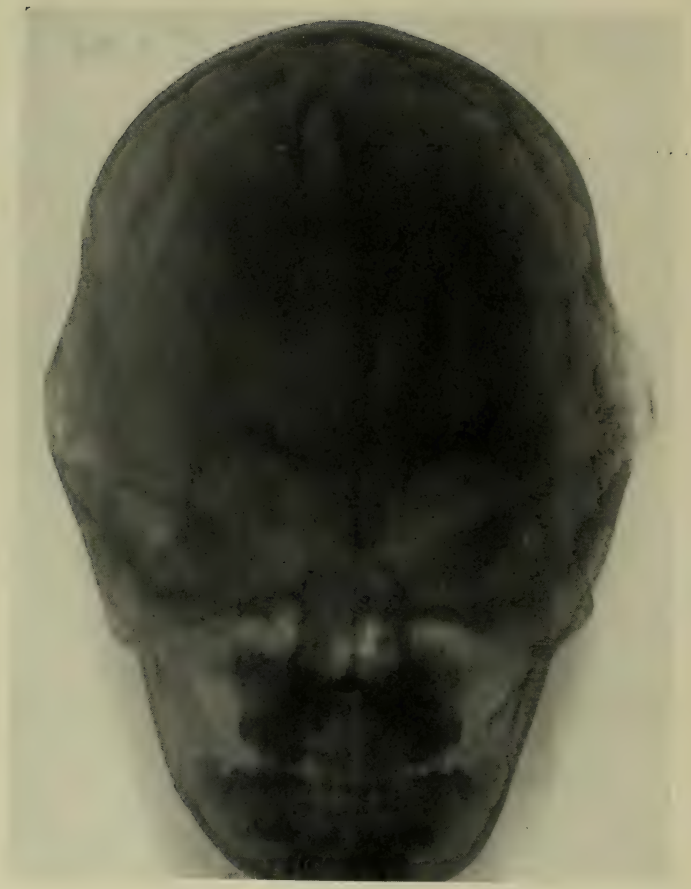

FIG. 5.—Case I. Two years after subtemporal decompression. Note ossification over decompression.

opinion regarding the cause of the increased pressure, most observers believing it to be due to the disproportionate growth of the brain and skull, while some, notably Meltzer, Vorschütz and Bramann, think it is due to an internal hydrocephalus.

Those holding the former view call attention to the fact that owing to the premature synostosis the skull cannot keep pace with the expanding brain, which grows very rapidly in the early years of life, consequently the skull becomes deformed and the constant pressure of the brain causes an atrophy of the skull even to the extent of producing considerable openings in it, "spontaneous decompression."

Meltzer thinks the increased intracranial pressure is due chiefly to internal hydrocephalus the result of a serous meningitis, but few autopsies have shown any chronic dilatation of the ventricles. Of six cases with autopsy collected by Schumacher, hydrocephalus was found in only one. In Vorschütz's case the hydrocephalus was due to the cerebellum being jammed in the foramen magnum. Internal hydrocephalus is certainly not constant—in fact it is apparently rare with oxycephaly, and, when it does occur, it is probably secondary.

Oxycephaly occurs much more frequently in males than in females, the proportion being about 5 to 1; of 17 cases collected by Friedenwald, 15 were males and 2 were females; of the 8 cases of Oberwarth 6 were males. Heredity seems to have little influence, though cases have been reported in two brothers or two sisters. The mentality is usually unimpaired; in fact the cases seem unusually bright, considering that they are often handicapped by poor vision or blindness.

Symptoms and Signs. In some cases there are no subjective symptoms, the skull apparently accommodating itself to the growing brain. In many cases there is headache and occasionally there are vomiting and convulsions. When these come on suddenly we might think of the possibility of an internal hydrocephalus. The cardinal signs are (1) the type of cranial deformity, (2) the exophthalmos with strabismus, (3) the impairment of vision.

The cranial deformity is generally very characteristic (Figs.

1 and 2). The skull is of unusual height, and its apex, just behind the region of the anterior fontanelle, is usually formed by a projection or crista sagittalis, corresponding to the sagittal suture. From here the parietal bones drop rather abruptly downward or there may be a hollow on each side of the crest. The forehead is high and steep. The superciliary ridges and the temporal ridges and depressions are feebly marked. The orbits are very high and very shallow. The palate is often high and narrow. The face may be asymmetrical, due usually to a flattening or depression in the malar and submaxillary region.

The roentgen picture is very striking (Figs. 3 and 4). The skull is usually thinned and marked by wave-like depressions, corresponding to the cerebral convolutions. The sutures are usually not seen. The base of the skull is deformed; the middle fossa is deepened so that it is almost on the same level with the posterior fossa; the sella turcica is widened and deepened; the great wings of the sphenoid are flattened out; the roof of the orbit may be almost vertical; the head sinuses are compressed and sometimes practically obliterated.

Exophthalmos with divergent strabismus is nearly always present in the well-marked cases, though the strabismus is occasionally convergent. The exophthalmos is due to the very shallow orbits. Nystagmus is very commonly present; it is usually bilateral and in all directions. The impairment of vision is marked in nearly all the cases. The cause of this impairment has been discussed above. It may be present at birth, but is usually noticed between the second and sixth years of life. It may progress to a certain degree and stop or go on to complete blindness. The loss of smell is not infrequent. Hearing is sometimes dulled and the sense of taste is occasionally lost. Oxycephaly may be associated with other congenital anomalies, but this is not strikingly frequent.

Treatment. It is only in recent years that operative measures have been undertaken with the object of combating the symptoms of increased intracranial pressure, especially the threatened blindness. Since most observers think that this

increased pressure is due to the disproportionate growth of the brain and skull, decompression seems to be the operation of choice; moreover, it has the advantage of simplicity and relative safety. It should be done early, for in cases with irreparable optic atrophy and no other pressure symptoms operation is not indicated. The results of this operation in the small number of cases in which it has been done are distinctly encouraging, in spite of the fact that the optic atrophy was rather advanced in most instances. In 1916 Sharpe reported four cases of oxycephaly in which he had done subtemporal decompression, unilateral in one and bilateral in three. The three cases in which the bilateral operation was done were followed and found to be greatly improved; the other case could not be traced.

The case here reported, in which I did a bilateral subtemporal decompression, was seen about two years after this operation. The parents stated that his general condition was much better and that he seemed to see better, as he stumbled much less in walking. He could count fingers at three feet, which he could not do before operation. Examination of the eyegrounds, however, showed practically no change, there being a marked optic atrophy in both eyes. An interesting feature of this case is that at operation the bulging of the brain was so marked that the temporal fascia could not be at all approximated on either side, therefore the defects were covered by transplanted patches of fascia lata. Another point of interest is the ossification of the tissues over the region of the decompression, this bone showing the same digital impressions as the rest of the skull (Fig. 5).

Considering the increased intracranial pressure to be due to internal hydrocephalus, Bramann and others have advised puncture of the corpus callosum in oxycephaly; but, as stated above, internal hydrocephalus seems rarely present in such cases. When doing a decompression we certainly would not omit a ventricular puncture if we have reason to suspect that internal hydrocephalus is present. The "Kanal operation" of Schloffer does not appeal very strongly to us, but it might be

justifiable in certain cases when a decompression has failed to improve the condition of the optic nerve.

Report of Cases. The first case is a typical case of oxycephaly which was admitted to the University of Virginia Hospital with advanced optic atrophy. The second case is certainly not typical, but I think it is a case of cranial stenosis, probably of the "turmschädel" type. The head is quite tall and the skiagram of the skull shows many of the characteristics of the steeple-head skull, but a marked anterior staphyloma in both eyes prevented my examination of the optic disks.

Case I.—T. W., colored male, aged four years, was admitted to the hospital, February 11, 1918, complaining of failing vision. Family history: Father, mother, two sisters and one brother living and in good health. No history of abnormalities in family. Previous history: Patient is the third child. His birth was not difficult. Had whooping-cough at nine months of age, after which mother thought eyes were more prominent than before. Present illness: Four months ago his mother noticed there was some trouble with the patient's sight. He seemed to be constantly running into things. Since then he has been getting worse. Mother says head has always been peculiarly shaped. There has been no headache, no vomiting, no convulsions. Physical examination: The boy is well-nourished and mentally bright. Head: Unusually tall (Figs. 1 and 2). Transverse diameter compressed in biparietal region. Forehead very high. Protrusion at bregma 4 x 6 cm. in diameter (crista sagittalis). Anterior and posterior fontanelles firmly closed. Supra-orbital ridges almost obliterated. Skiagrams of skull (Figs. 3 and 4) show all the characteristics of the oxycephalic skull as described above. The "digital impressions" are unusually well marked. Cranial measurements: Hat circumference 48.5 cm., bimeatal arch 35 cm., chin to nasion 11 cm., width of orbit 3.5 cm., height of orbit 4 cm., intercanthi 3 cm. Face: Symmetrical. Eyes: There is marked exophthalmos. Left eye shows internal strabismus. There is a marked impairment of vision, shown by the fact that he is unable to recognize familiar objects. He walks in a

wandering fashion, with a tendency to feel his way and often stumbles on things. The light reflex is present. Ophthalmoscopic examination shows marked bilateral optic atrophy. Nose: Negro type, flat and wide. Septum is deflected. Sense of smell normal. Mouth: Palate rather high. Tonsils very large. Ears: Low placed, but normal in shape. Hearing normal. Heart, lungs and abdomen, negative. Extremities: Negative. No evidence of rickets. Motion and sensation normal. No other abnormalities of any kind made out. Wassermann test, negative.

Operation, February 16, 1918: A bilateral subtemporal decompression was done. Temporal muscles very thin. The skull was extremely thin, in fact almost as thin as paper, and at one point on the left side there was a definite opening 5 mm. in diameter, due to pressure atrophy. Openings the size of a silver dollar were made on each side of the skull and through there openings there was a very marked protrusion of dura and brain. The dura was not opened. An attempt was made to suture the temporal fascia, but it could not be brought together, so patches of fascia lata 4 to 5 cm. in diameter were transplanted to cover defects and sutured with fine silk. The wounds healed *per primam* and the patient made an uninterrupted recovery from operation.

He returned for examination on December 5, 1919. Mother says his general condition is much better and she thinks he can see better, as he stumbles much less in walking. He can count fingers at three feet with the right eye and with the left eye he can see movements of the hand at three feet, which is a distinct improvement over vision before operation; but examination of the eye-grounds shows no improvement. There is advanced optic atrophy, the disks being white and indistinct in outline. Examination of head shows protrusions 6 cm. in diameter and 1 cm. high in the region of decompression. Protrusions are covered with bone, as shown by roentgen-ray photograph (Fig. 5).

Case II.—T. A., colored, female, aged about four years, was admitted to the University of Virginia Hospital, September

23, 1919, complaining of sore eyes and loss of sight. Family history: Father living and well. Mother has had "epileptiform attacks" for eight to ten years. No brothers or sisters. Previous history: Mother had a very stormy time at patient's birth, was in labor for several days and was delivered with forceps. No disease of childhood except whooping-cough. Present illness: Several days after birth mother noticed "corruption" in child's eyes and some days later she noticed a whitish covering over the eyes. This opacity and the bulging of the eyes have gradually grown worse, and about five months ago the left eye "burst." Mother has not noticed any peculiarity in the shape of the head. There has been no headache, no vomiting, no convulsions. Physical examination: Child is fairly well nourished. Mentality is good, especially considering the deprivation of vision. Head: The tall head and high forehead are striking, but there is no protrusion at the bregma. The union of the cranial sutures is apparently normal. No ridges along the cranial sutures. The supra-orbital ridges and the temporal ridges and depressions are feebly marked. Skiagrams of skull show it to be unusually thick and "digital impressions" are not marked except in the lower portion of the parietal and in the temporal bones; but the middle fossa is wide and deep and is only slightly above the level of the posterior fossa. The head sinuses are almost obliterated. The orbits are high and shallow. Cranial measurements: Hat circumference 48 cm., bimeatal arch 24.5 cm., biparietal diameter 13 cm., bitemporal diameter 12.5 cm., width of orbit 3.1 cm., height of orbit 3 cm. Face: Symmetrical, comparatively small for the cranium. Eyes: Slight exophthalmos is noted, with divergent strabismus, more marked in the left eye. Nystagmus is present, bilateral and in all directions.

Owing to the anterior staphyloma resulting from gonorrheal ophthalmia examination of the eye-grounds is rendered impossible and we cannot determine whether optic atrophy is present. Vision in both eyes is practically destroyed; large objects, light and dark, only being perceived. Nose: Negro type. Septum not deflected. Sense of smell normal. Ears: Placed very low

but normal in shape. Hearing normal. Mouth: Palate quite high and narrow. Heart, lungs and abdomen: Negative. Extremities: Negative. No evidence of rickets. Motion and sensation normal. No other abnormalities of any kind made out. Wassermann test: Negative.

References

1. Friedenwald, H.: Cranial Deformity and Optic Nerve Atrophy Am. Jour. Med. Sc., 1903, cv, 529.

2. Oberwarth, E.: Ueber Turmschädel, Arch. f. Kinderheilk., 1905, xlii, 79.

3. Fletcher, H. N.: Four Cases of Oxycephaly, Proc. Royal Soc. Med., 1908–9, vol. ii, Clinic Section.

4. Meltzer: Zur Pathogenese der Opticusatrophie und des sogenannten Turmschädels, Neurologisches Centralbl., 1908, xxvii, 562.

5. Gordon, A.: Optic Nerve Changes Associated with Cranial Malformation, New York Med. Jour., 1911, xciii, 7.

6. Anton and v. Bramann: Weitere Mittheilungen über Gehirndruck-Entlastung mittelst Balkenstiches, München. med. Wchnschr., 1911, lviii, ii, 2369.

7. Schumacher: Entlastungstrepanation oder Balkanstich bei Turmschädel mit Hirndruckerscheinungen, München. med. Wchnschr., 1912, lix, ii, 2282.

8. Schloffer: Zur Behandlung der Sehstörungen beim Turmschädel, Verhandl. d. deutsch. Gesellschaft f. Chir., 1913, xlii, 141.

9. Küttner: Der angeborene Turmschädel, München. med. Wchnschr., 1913, lx, ii, 2209.

10. Berlotti, M.: Le syndrome oxycephalique ou syndrome de cranio-synostose pathologique, Presse médicale, 1914, xxii, 332.

11. Herzog, T.: Beitrag zur Pathologie des Turmschädels, Beiträge z. klin. Chir., 1914, xc, 464.

12. Strebel, J.: Ueber die Selbsttrepanation der Natur beim Turmschädel und über das Wesen des turricsphalus, Correspondenzbl. f. Schweiz. Aerzte, 1915, xlv, 513.

13. Sharpe, W.: The Cranial Deformity of Oxycephaly; its Operative Treatment, with a Report of Cases, Am. Jour. Med. Sc., 1916, cli, 840.

14. Bedell, A. J.: Oxycephalus, Report of Three Cases, with Operation in One, Jour. Am. Med. Assn., 1917, clxviii, 1979.

DISCUSSION

Dr. Coleman, Richmond, Va.—I should like to speak of two observations made by Dr. Watts in the discussion of this very instructive paper. He spoke of new bone formation on the decompressed area. In a series of operations for hydrocephalus in young children I found that if the pericranium was removed with a sharp instrument, carrying back some of the superficial layer of the bone, we frequently had a deposit of very rich mucous membrane simulating bone formation. It undoubtedly was semibone formation. This caused me to vary my technic somewhat, and instead of removing the temporal muscle from the bone with a sharp periosteal elevator, I inserted a pair of scissors under the muscle, clipped it off and retracted it in that way.

In regard to the closure of decompression wounds made for progessive intracranial tension of this type, I have found, with the old method of technic, such as making lateral incisions through the fascia on either side, the main operative incision would frequently allow approximation of the fascia and make a weak place in the fascia to the side and over the muscle. This, of course, does not throw two weak points in the same plane.

It would seem that some of the obscurity of this trouble might be cleared up, if, after operation upon every case, a ventricular puncture was made as suggested by Dr. Watts. This is a routine method in intracranial operations at Keen's point for suboccipital exploration.

AUTOGENOUS BONE-GRAFTING FOR REPAIR IN FRACTURES OF LONG BONES

By Frank Martin, M.D.
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Probably no class of cases occurring in the present war has offered more important and interesting problems for solution than gunshot fractures of long bones. The frequency of the wounds of the skeleton with the varying conditions incident to the surgical care, which each individual fracture demands, has placed this group of war injuries in the very forefront. It must be remembered that all of these fractures are compound and many badly comminuted, and the cases here recorded as illustrations for this type of reconstruction, namely, repair by autogenous bone grafts, have suffered not only varying degrees of loss of bone substance, but in most of them a raging and often even an uncontrollable suppuration has already occurred, so that when they arrived they had not only nonunion but widespread osteomyelitis and bone sinuses of the fragment ends, together with considerable loss of soft parts either from large gutter wounds or perforating wounds of both soft parts and skeleton showing marked explosive and destructive effects. These are indeed truly complicated fractures and call for the most exacting and approved surgery.

I do not propose to take up the history of bone transplantation (which is indeed a most interesting one), nor do I intend to touch upon the histological side of the subject, as seen from the viewpoint of the pathological anatomist, for if success were dependent on the pathologist's conception of successful transplantation the surgeon would achieve success only

rarely. It is the clinical success of bone regeneration and ultimate union that is of chief importance to the working surgeon. Nor will time permit of a discourse on the various methods of bone fixation (Lane plate, bands, wire, screws, or what not), except to say in all of the cases recorded bone grafting necessarily was the method of choice, and in my judgment none of the other devices was applicable for the following reasons:

1. Definite loss of bone substance, which in quite a number of the cases was marked (one to three inches).

2. Long interval of time from receipt of injury in which non-union and malunion had existed, with necessarily definite loss of osteogenetic function in the ends of the bone fragments, they being embedded in scar-tissue and possessing no possible bone repair save by bone scaffolding to bridge, from healthy bone above, over the gap to healthy bone below in the lower fragment. This interval was frequently a long one and required a long graft to bring about bone regeneration.

3. In order to obviate undue shortening, and give to the member as fair an alignment as possible, a living bone graft, therefore, is eminently the most satisfactory method to accomplish these results.

It is common knowledge that the best results are obtained by means of autoplastic transplantation, in which method the transplanted tissue is grafted into the body from which it has been obtained, and is always to be preferred to homoplastic or heteroplastic transplants; furthermore, clinical success is more sure to follow where the implanted living graft has elements, both of the periosteal and medullary layers (Lexer). This was shown by Ollier, and it is well known today that the graft retains its viability longer, and its power of bone regeneration is greater, if the periosteum is preserved; whether the graft acts other than a scaffold, being slowly encapsulated, and stimulating the surrounding periosteum and bone elements to bring about regeneration and bone repair, while it slowly disintegrates and becomes absorbed, I cannot say, but that it does stimulate bone regeneration I am thoroughly convinced.

The uncertain and indefinite knowledge we have of exactly what happens to the autogenous bone graft after its transplantation has brought forth much valuable experimental study, and there still exists wide diversity of opinion. However, the general belief is that the bone graft itself, provided it has periosteal and endosteal surfaces, contributes to osteogenesis, and that the new bone is limited to these surfaces. If, however, the periosteal and endosteal surfaces of the graft are completely removed, no bone grows from the transplant[1]. Again, it is stated that the power of regeneration varies with the age of the individual, that grafts are more liable to live and produce growth and union in the young than in the old, and still more liable to bring about active regeneration if it has been stimulated into a growing graft before being transplanted by a so-called "two-stage operation." "Partly cut the graft with a motor twin saw, leave it in its attached bed and close the wound. The graft is later removed and transplanted at a second operation" (Brooks). This, in my estimation, is impracticable when applied to the human.

Important Factors in Grafting Bone. In removing and implanting grafts many factors can easily enter which will weaken or destroy the viability of the graft, such as chemical contact, drying or burning graft with a too hot saw or other mechanical injury, and to achieve the best results these factors must be guarded against. The more quickly and surely the graft is implanted and definitely fixed the more promptly is nourishment assured. Intimate apposition, which will assure early adhesion between the wound edges and the transplant, will more certainly serve the function of supplying, as quickly as possible, nutrition to the graft. The most important contributing factor to failure, next to improper technic, is imperfect hemostasis, as it prevents intimate adhesion of the graft with the wound edges and invites infection.

Methods for Graft Fixation. The bone transplant may be removed from one of the fragments and brought over the defect by the so-called sliding inlay and secured in place by kangaroo tendon, or where the defect is not great and the

[1] Brooks: Annals of Surgery, December, 1917.

alignment is good a long graft may be cut with a motor twin saw right across the point of non-union and the graft reversed so that the best portion of the graft will bridge the gap and be tied in place by kangaroo tendon. (Several non-unions of the tibia in this series were dealt with in this manner by the writer.) The chief objection to the sliding inlay graft is that the transplant is often obtained from a bone which has poor power of regeneration. The most favorable graft is the one removed from another bone and transplanted, either being fixed by the intermedullary method or an inlay made for its reception as a bed into which it should fit snugly and there fastened with tendon. A graft to do well must be firmly fixed and definitely immobilized; if this is not observed, failure is very often liable to occur. Personally, I prefer a transplant from another bone, and in the majority of these cases the graft was secured from the tibia.

Chief Factors for Successful Bone-Grafting. (1) Perfect aseptic technic. (2) Avoidance of mechanical injury or trauma to graft (burning with saw or what not). (3) Scrupulous avoidance of traumatizing tissues. (4) Definite and firm fixation of graft. (5) Allow a long interval to elapse after complete healing of wound. Grafts will not remain viable where there is infection. (6) Perfect hemostasis.

The writer agrees with the following remarks of Groves[1], quoted from notes in *Review of War Surgery and Medicine*, and issued by the Surgeon-General's Office. He believes "it bad surgery to remove any attached fragment from a comminuted fracture and doubly bad to cut off the ends of the main fragments, because in throwing off infections they also throw out reparative callus." As the osteoblast is the bone-building cell the more bone saved the more chances of bone proliferation, and, as bone will be manufactured out of fibrous tissue of the periosteum and other structures, marrow or what not, it is wise policy to leave as much bone as possible in order that the graft will be an aid in the bone formation.

[1] British Jour. of Surg., 1918, vi, 203.

TREATMENT, PREOPERATIVE. Every care is given bone and joint casualties during the long period of waiting prior to the final operative repair work (grafting or what not), made necessary especially in those associated with slow-healing, infected open wounds, to avoid preventable deformities, muscular contractions, joint ankylosis in faulty positions, etc. In fact, every means is directed toward this conservation of function by means of suitable retentive splints, massage and proper physiotherapeutic treatment, together with diverting work and active exercise on the part of the man himself. It has accomplished excellent results in preventing avoidable loss of function or deformities in adjacent joints. If there is reasonable assurance in advance that ankylosis of a joint will occur, the best possible position for the ankylosing joints is determined upon, and the joint is fixed accordingly by the application of splints, traction apparatus, plaster casts or other appliances to secure proper fixation and alignment of the fractured bone which will permit of the dressings and necessary care of unhealed wounds, the function of the adjacent joints never being lost sight of. The chief aim is to preserve as complete function as can possibly be attained. The patient, after having had his antitetanic serum and his preoperative preparation, comes to operation.

OPERATION. These are distinctly major operations. The work is not only difficult but hazardous, and requires the most perfect technic and a thorough grasp of regional anatomy. Nothing is more important than constantly freshening one's mind on the regional anatomy, and in this way keeping a vivid impression of the structures to be protected and those to be avoided. Bloodvessels must be kept constantly in mind and respected, and the distribution and exact location (anatomical) and relations of the nerves must be remembered at all times. Indeed, the preservation and protection of the latter cause me more anxiety than any other steps in the operation. Especially true is this in grafting the humerus, for fear of wounding the musculospiral nerve.

Regional Considerations. A. *Upper extremity.* 1. Humerus: In doing an autogenous bone-grafting operation on the humerus the following structures are to be avoided: In preparing the field for either an intermedullary or inlay graft in the upper third posteriorly and above the definite location of the circumflex nerve must be borne in mind and protected from injury. In the middle of the shaft and posteriorly and to the outer side the musculospiral nerve. Internally the ulnar and median nerves and the brachial vessels. The best incision is antero-external, as the exposure for a greater distance can be here made with least danger to the musculospiral nerve, which is the principal structure to be avoided. 2. Ulna: The incision of choice is posterior in both upper and middle thirds. 3. Radius: The placing of the incision is on the radial or outer border of forearm.

B. *Lower extremity.* 1. Femur: The best incision and most logical one for reaching any portion of the shaft of the femur is on the outer aspect of the thigh. This incision admits of freely uncovering and delivering the fragments into the wound with the least danger to the important structures, and the incision can be safely made as long as desired without serious damage, barring infection. 2. Tibia: The incision of election is on the antero-internal surface, and it can be made the full length of the bone without damaging any important structures. 3. Fibula: The best incision for uncovering this bone is external. The principal nerve to be avoided is the superficial peroneal nerve.

Treatment, Postoperative. Regarding the postoperative treatment the same principles apply as for preoperative treatment, and as soon as justifiable the patient is given the benefit of the efficient services of the Reconstruction Aides. Just here should come a word of caution, namely, that at the beginning of treatment by Reconstruction Aides the greatest care possible is to be observed by them in their handling and manipulation, to avoid any damage to the early fragile callus that necessarily is slow in forming around these grafts, especially when the loss of substance in the shaft of the long bones has

been extensive, requiring a long graft to bridge across the gap. I call attention especially to this in view of the fact that in one case of graft of the humerus the graft had to be seven and one-quarter inches long to fill in the defect. All went well in this case and complete union had occurred, external splint removed, and, after a few treatments were given, pain was complained of and on further roentgen-ray examination a fracture of the graft was noted in the distal socket of the lower fragment. The line of fracture was well within the inlay of the lower fragment and completely surrounded by new-bone formation (callus), so that the case will probably not be seriously retarded.

Summary of Cases. This article includes eighteen cases, with their respective histories and illustrations. In one case the graft did not retain its viability. Humerus, 7; radius, 4; ulna, 1; femur, 2; tibia, 4.

Case 1.—Autogenous bone graft. Humerus. J. M., Pvt., Co. C, 52d C. A. C. Age 23. Home address, Willowdale, Kansas. Date of admission, March 8, 1919. Date of injury, November 12, 1918. Date of operation, March 14, 1919. *Diagnosis.* Old compound, comminuted fracture, left humerus, middle third. Absence of bone shaft for a distance of 1 cm. incurred by accidental explosion of shell in camp, Verdun Sector, France, November 12, 1918. *Operation.* Resection humerus, left. Five inches graft taken from tibia, left. Inlay. Incision of antero-external to outer side of biceps muscle. Point of non-union uncovered. Periosteum incised to full length of incision and stripped back from shaft both above and below seat of fracture. Inlay cut with Albee saw and prepared for graft which was taken from tibia and fixed by kangaroo tendon. *Operator,* Lieut. Col. Frank Martin; Lt. Hatch; Lt. *Fields. Remarks.* Wound healed under one dressing. Still in cast. *Result.* Too soon to give ultimate prognosis, but all seems well. *Note.* June 4, 1919. Since this article was written delay occurred in its being sent off, thus enabling me to give more definite data as to results. At present writing the cast has been removed and a more recent roentgen-ray examination

reveals complete bony union and arm in perfect alignment. There was evidence in this case, upon entrance, of a peripheral nerve lesion, probably a complete anatomical division, principally involving the musculospiral nerve.

Case 2.—Autogenous bone graft. Humerus. F. G., Pvt., Co. E, 141st Inf. Age 29. Home address, Pampa, Texas. Date of admission, December 29, 1918. Date of injury, October 7, 1918. Date of operation, January 7, 1919. *Diagnosis.* Fracture, old, comminuted, humerus right, ununited at junction of upper and middle third. Result of gunshot wound, shrapnel, received on Champagne Front, France, October 7, 1918. *Operation.* Open operation, spongy bone at end of both upper and lower fragments removed for distance of about 2 inches in order to get down to solid, healthy bone. Medullary bone graft 7⅓ inches long taken from right tibia and inserted firmly in medullary canal of upper and lower fragments. *Operator,* Lieut. Col. Frank Martin; Capt. Brothers. Remarks. Wound healed under one dressing, slight evidence of callus at the insertion of the graft into both upper and lower fragments in one month. On April 25, 1919, splint removed and union firm. He was taken over by the Reconstruction Aides for massage treatment. Some slight pain was noted at lower end of arm after a few days of massage, and upon roentgen-ray examination it was found that a fracture had taken place at the lower insertion, but callus was developing all around and holding the graft fairly well, so a cast was reapplied. It is hoped that callus will continue to be formed. *Note.* June 4, 1919. Good, firm, bony union in this case at both ends of the long graft. It has not completely bridged across this large gap but is progressing satisfactorily; his forearm and hand have recovered full strength, and the psychological peripheral nerve lesion of the musculospiral nerve has entirely recovered. Upon entrance he had a very definite wrist drop; this has entirely cleared away, as will be seen from the photograph of the patient's arm. There is a serious disturbance of the soft parts, clearly shown by a deep gutter wound on the anterior aspect of the arm, and the muscles at this site have been seri-

ously damaged, and the impairment of function incident to this will be slow in returning.

CASE 3.—Autogenous bone graft. Humerus. E. A., Pvt., Co. M, 41st Inf. Age 29. Home address, Washington, Mo. Date of admission, January 25, 1919. Date of injury, October 6, 1918. Date of operation, February 20, 1919. *Diagnosis.* 1. Fracture, ununited, compound, old, lower third humerus right, with loss of about 1 inch of bone. 2. Osteomyelitis, chronic, mild, of ends of fragments. One and two result of gunshot wound, machine-gun bullet, received in action in Argonne Forest, France, October 6, 1918. *Operation.* Bone graft. Piece of bone five inches in length taken from right tibia. One end placed securely in medullary canal of lower fragment and the other fastened in groove prepared for same in upper fragment by means of kangaroo tendon. *Operator,* Lieut. Col. Frank Martin; Capt. Brothers; Lt. Hatch. *Remarks.* Healed under one dressing. *Result* (at end of six weeks): Light cast still on. Roentgen-ray shows graft viable and callus forming satisfactorily. *Note.* June 4, 1919. Cast has been removed, arm is getting stronger each day. There is now good bony union, with improvement as to function of joints (especially elbow), noted from day to day. On entrance this patient had evidence of peripheral nerve lesion (musculospiral). Evidence principally wrist-drop; at present writing this has entirely cleared away. Roentgen-ray report shows callus formation going on entirely satisfactorily.

CASE 4.—Autogenous bone graft. Humerus. J. A. H., Pvt., Co. A, 355th Inf., 89th Div. Age 23. Home address, De Witt, Neb. Date of admission, February 17, 1919. Date of injury, November 4, 1918. Date of operation, April 8, 1919. *Diagnosis.* Compound, comminuted fracture, humerus left, upper third, slight fibrous union, loss of substance. Incurred in action on Verdun Front, France, November 4, 1918, by machine gun bullet. *Operation.* Autogenous bone graft six inches in length, humerus left. Graft taken from tibia left. *Operator,* Major Dickson; Capt. Adams; Capt. Kaufman. *Result.* Undetermined. Progress satisfactory. Still in cast.

Roentgen-ray findings. Before operation: Old comminuted fracture of the left humerus at the junction of the upper and middle thirds. Moderate amount of angulation backward and upward. Absence of the shaft of the bone a distance of 6 cm. The interval is bridged across by a formation of callus, 1 cm. in diameter, which has been fractured. No other callus formation. After operation: Bone graft of the left humerus. Slight angulation inward at upper end of graft. Otherwise fragments are in good position. Shoulder joint appears normal.

CASE 5.—Autogenous bone graft. Humerus. C. H. B., Cpl. Gas Defence, M. O. T. C. Age 24 years. Home address, Loveland, Colo. Date of admission, July 10, 1918. Date of injury, March 1, 1918. *Diagnosis.* (1) Ununited fracture humerus, left, at middle of middle third. (2) Entire paralysis of left arm, with complete musculospiral involvement. One and two accidentally incurred by being struck by motor car at Kansas City, Mo., March 1, 1918. *History.* Patient treated in Kansas City. On admission, ununited fracture was noted with paralysis. *Neurological report.* The slight hemianesthesia, left, is undoubtedly psychic, as there are no other symptoms of an organic nature. There seems little question about the brachial plexus involvement as the area of nerve supply from the plexus is involved, namely, sensory, motor and resulting atrophy. Whether the brachial plexus involvement is primary at time of accident, or secondary to pressure from cast due to an ascending neuritis from musculospiral involvement at seat of fracture, is not known, as the soldier was not examined until some weeks after the accident when the prominent features were wasting of pectoral, scapular and shoulder joint regions, making it appear as if there were damage to the plexus proper rather than secondary to trauma lower down. There seems to be reason for bone graft and at the same time musculospiral will be exposed, which, if found injured, can be remedied; but it is believed most of the trouble is higher up in plexus. MAJOR TRUITT, M. C. *Operation,* August 20, 1918. Open operation, fixation of fragments by autogenous bone graft, removed from tibia, inlay, Albee saw, fixed with kan-

garoo tendon. *Operator,* Lieut. Col. Frank Martin, M. C.; Lt. Sharpe, M. C. *Result.* Healed under one dressing and made an uninterrupted recovery. *Ultimate result.* Complete restoration of all the peripheral nerve lesions and patient sent to duty October 1, 1918, with an excellently united fracture and perfect function of arm.

Case 6.—Autogenous bone graft. Humerus. T. D. G., Pvt., Co. 461, M. T. C. Age 20 years. Home address, Springhill, Kansas. Date of admission, April 11, 1919. Graft removed from tibia, five inches long for repair of non-union at junction of middle and upper third, right. Date of injury, February 12, 1919. *Diagnosis.* Fracture humerus right, simple, junction of middle with upper third. Accidentally incurred while riding motorcycle, ran into horse which came out on road, from a bypath, at Libourne, France, February 12, 1919. Entered here with ununited fracture humerus right. *Date of operation.* May 2, 1919. *Operation.* Bones delivered by Lane forceps through an antero-lateral incision. Fragments freshened by sawing off the fibrous ends. Inlay cut with Albee saw and graft six (6) inches from tibia inserted. Plaster cast applied. *Operator,* Lieut. Col. Frank Martin, M. C.; Capt. Brothers, M. C.; Lt. Hatch, M. C. *Remarks.* Wound healed under one dressing. Patient still in cast. Both wounds, arm and leg, perfectly united. *Results.* Undetermined, prospects very good. *Note.* June 3, 1919. Cast removed June 3, 1919 (just thirty-two days following operation), as will be seen from roentgen-ray marked "after operation." Callus has already formed, bridging across gap incorporating graft and giving firm bony union and excellently straight skeleton with fragments in perfect alignment. There is no loss of function whatever in this case. Having been immobilized for so short a time the joints and muscles have not been impaired in the least and he has full use of shoulder and elbow.

Case 7.—Autogenous bone graft. Humerus. A. H., Pvt., Co. I, 353d Inf. Age 32. Home address, Inman, Kansas. Date of injury, November 3, 1918. Date of admission, March

5, 1919. Date of operation, May 21, 1919. *Diagnosis.* Fracture, humerus, middle third, right (ununited), with musculospiral paralysis (wrist drop), following rifle bullet wound, perforating shaft and shattering it into many fragments. Incurred while in action Argonne Forest, France. *Neurological report.* "This is a complete brachial palsy due to an ascending neuritis (neuritis migrans) which occurred as the result of the presence of an infecting wound. The musculospiral, ulnar, median, suprascapular and circumflex nerves all show involvement which is physiological and incomplete. There is no skin anesthesia; on the contrary, there is hypersensitiveness to touch, pain and deep muscular impressions. There is loss of excitability to both interrupted and galvanic currents; no well-defined R. D. in any of the muscles. There is some atrophy and paralysis of the spinati, paralysis of action of the anterior and middle scaleni, direct injury to the deltoid near its point of insertion as well as involvement of its nerve. Recommendation: Carefully executed active and passive motion with very light massage." E. C. Fischbein, Capt. M. C., U. S. A. *Roentgen-ray findings.* Old comminuted fracture in the middle third of the right humerus. There has been extensive shattering of the bone. Numerous small detached fragments in the region of the injury. A shell of bony tissues 1 cm. in width and ½ cm. in thickness connects the two main fragments. Moderate amount of callus formation. Advise return for elbow.—O. R. Brittain, 1st Lt. M. C., U. S. A. *Operation.* Bones separated and freed and graft from tibia taken for fixation. Intermedullary in upper fragment and inlay in lower fragment. Kangaroo used to fix graft in lower fragment. *Operator,* Lieut. Col. Frank Martin; Capt. Brothers; Lieut. Fields. *Result.* All is going well, result as yet undetermined.

Case 8.—Autogenous bone graft. Radius. W. C., Pvt., Co. G, 127th Inf. (Overseas). Age 22 years. Home address, Downs, Kansas. Date of admission, December 29, 1918. Date of injury, August 31, 1918. Date of operation, January 24, 1919. *Diagnosis.* (1) Fracture of radius, left, compound, comminuted. Entire middle third blown out. (2) Peripheral

nerve lesion, musculospiral and ulnar involved at site of wound, middle forearm. (3) Big gutter wound, healed, involving inner and lateral surface of forearm. (1, 2 and 3) Incurred while in action near Soissons, France, by machine-gun bullet. Interval of time from receipt of wound to admission; hospital four months. Interim after admission before operation twenty-six days. *Operation.* 1. Open operation bone-grafting. Bone delivered and showed extensive osteomyelitis. Graft 5⅛ inches taken from tibia, left. *Operator,* Lieut. Col. Frank Martin; Capt. Brothers; Lieut. Hatch. *Neurological report.* The ulnar nerve has escaped, the poor functioning of muscles supplied by it being due to interference from surgical causes. The radial branch of the musculospiral has been completely divided, but several filaments of this nerve are still active as will be mentioned below, these filaments coming off above site of the lesion. Extension is lost on this account, as also on account of the fact that extensor muscles have been directly divided. There has also been complete division of the median nerve anatomical in character with paralysis of its muscle of supply. There is fixation of the wrist joint as a result of tendon contracture. Both pronators of the wrist have been directly injured. The fingers are in a position of extension, due to paralysis of the deep and superficial flexors of the fingers; the extended fingers can be slightly flexed, this, however, being due to action of the interossei. All the thenar muscles are paralyzed with exception of the abductor of the thumb, which is, however, weak from disuse. All extensors of the wrist and hand are paralyzed with the exception of three muscles, *i.e.,* the extensor ossis metacarpi pollicis, the extensor indicis and the extensor minimi digiti; the action of these three muscles, combined with that of the interossei and the two inner lumbricales, performs the limited motions which are present in the wrist and hand. *Prognosis.* Poor for practical functioning of this hand; active and passive massage will undoubtedly do some good; an attempt should be made to restore median nerve function by surgical means, remembering that this member has been in a splint for a little over seven

months. Capt. Fischbein, M. C. *Result.* Wound healed under one dressing. The operative wound of the forearm was necessarily made through considerable scar tissue in consequence of a very deep long gutter wound of soft parts, received at same time and by same projectile that blew out his radius. This is mentioned for the reason that where the operative incision has to be made through such dense scar tissue it frequently breaks down, but there was nothing of the kind in this case. Inspection of the photograph of the roentgen-ray plate following operation will show very excellent alignment and the two bones lying parallel. The nerve complication has considerably improved, but there is still definite evidence of an anatomical nerve lesion.

Case 9.—Autogenous bone graft. Radius. R. B. R. Pvt., Co. A, 10th Am. Tr. Home address, Polo, Mo. Date of admission, January 13, 1919. Date of injury, December 20, 1918. Date of operation, January 15, 1919. *Diagnosis.* Fracture radius right, simple, junction of lower and middle third, with resulting malunion. Accidentally incurred while cranking auto-truck at Detroit, Mich., December 20, 1918. *Operation.* Open operation bone graft with sliding inlay method. Case applied. *Operator,* Lieut. Col. Frank Martin; Lieut. Hatch. *Remarks.* This patient made an uneventful recovery. Wound healed under one dressing. Firm union developed in about six weeks. *Result.* Eminently satisfactory. Firm union and perfect alignment. Last roentgen-ray picture shows considerable callus formation.

Case 10.—Autogenous bone graft. Radius. G. J., Pvt., Co. E, 353d Inf., 89th Div. Age 25. Home address, McCracken, Kansas. Date of admission, March 11, 1919. Date of injury, November 5, 1918. Date of operation, April 4, 1919. *Diagnosis.* Compound, comminuted fracture, radius right, 6 cm. above wrist joint. Loss of 4 cm. of bone. Incurred in action in Argonne Forest, France, November 5, 1918, by high explosive fragment. *Operation.* Resection of ends of fragments, radius right. Autogenous bone graft taken from tibia right, 6 cm. in length. Fastened in groove of upper fragment

and in medullary canal of lower fragment. *Operator,* Lieut. Col. Frank Martin; Capt. Brothers; Lieut. Hatch. *Remarks.* Wound healed under one dressing. As will be seen from roentgen-ray plate he has perfect alignment and satisfactory callus formation going on. *Result.* Arm still in cast and too soon to know ultimate result, but union seems to be going on perfectly. *Note.* June 3, 1919. Since the date in the case history of the above case was written the cast has been removed. Both wound in arm and leg healed primarily under one dressing, and as will be seen from roentgen-ray picture marked "after operation" there is perfect correction of skeleton and excellent alignment. Good firm bony union has occurred and patient is fast regaining complete function of hand and arm.

Case 11.—Autogenous bone graft. Radius. N. O. B., Civilian. Age 64. Home address, Baltimore, Maryland. Date of admission, November 11, 1919. Date of injury, 14 months prior. Date of operation, November 14, 1919. *Diagnosis.* Old fracture lower ends of radius and ulna, with dislocation of lower end of ulna, non-union and angular deformity of 14 months' duration. *Operation.* Incision over radius, fragments separated and delivered into wound by Lane bone holding forceps. The medullary canals were then opened with the Albee electrical drill, and a four-inch graft, removed from the tibia, was transplanted and placed in the medullary canal of the upper fragment and the lower fragment brought over the protruding end of the graft and fixed in position. Dressings were applied, and arm fixed in plaster cast. Wound in leg was closed. *Operator,* Dr. Frank Martin. *Result.* Patient suffered no shock, nor showed any reaction, temperature not going above normal. Patient ran an aseptic course, and both wounds healed under one dressing. *Remarks.* December 10, 1919. Patient is still in the hospital and progress is most satisfactory.

Case 12.—Autogenous bone graft. Ulna. L. F. J., Pvt., Co. E, 354th Inf., 89th Div. Age 31. Home address, Seaforth, Minn. Date of admission, February 27, 1919. Date of injury, September 29, 1918. Date of operation, March 21, 1919.

Diagnosis. Fracture, old, compound, comminuted, with loss of about one inch of bone in lower third, right, ulna. Result of gunshot wound, schrapnel, received in action on St. Mihiel Front, France, September 29, 1918. *Operation.* Resection of ends of fragments and removal of all fibrous tissue and callus, leaving a gap of about 2½ inches between fragments. Graft and inlay made with Albee saw. Graft of 2¾ inches taken from tibia, and fastened in place with kangaroo tendon. *Operator,* Lieut. Col. Frank Martin; Lieut. Hatch; Capt. Peterson. *Remarks.* In this patient there was a gutter wound, and the incision had to be made necessarily through the scar tissue. The scar tissue broke down and the incision has not entirely closed. The roentgen-ray indicated that the graft is viable, but I am not entirely convinced that trouble may not appear later. *Result.* Apparently good, undetermined. *Note.* June 4, 1919. Callus formation in this case has occurred very satisfactorily and the last roentgen-ray picture taken June 3, 1919, shows callus bridging entirely across from fragment to fragment. This is abundantly shown and the graft is almost completely absorbed. The outcome as to the restoration of his skeleton and complete function will be eminently satisfactory.

Case 13.—Autogenous bone graft. Femur. V. V. J., Pvt., Co. G, 139th Inf. Age 22. Home address, Cawker, Kansas. Date of admission, March 19, 1919. Date of injury, September 29, 1918. Date of operation, April 5, 1919. *Diagnosis.* Fracture, compound, femur left, in lower third, resulting in malunion with 3 inches shortening. Result of gunshot wound, machine-gun bullet, received in action in Argonne, France, September 29, 1918. *Operation.* Refracture of femur. Removal of excessive callus. Sliding inlay bone graft taken from upper fragment. Cast applied. *Operator,* Lieut. Col. Frank Martin; Major Dickson; Capt. Kauffman; Lieut. Hatch. *Remarks.* This proved to be a very difficult case. A glance at the roentgen-ray picture and notation of the great shortening with a firm, bony lateral union between fragments will show what I mean. The chief difficulty was to overcome the shortening without shortening the thigh. When the bony union

was chiseled apart and an effort made to deliver the fragments into the wound (which was on external aspect of thigh), there was excessive hemorrhage from the new blood supply which had formed at the site of the union. This, however, was soon arrested when the fragments were unlocked and delivered, and by making firm extension it was found that the fragments could be brought practically end to end. The sharp points of the fragments were sawed off and a perfect end-to-end apposition was accomplished. Prior, however, to finally bringing them end to end, a sliding graft was cut from upper fragment and fastened in place; and when lower fragment was brought end to end, all that was necessary was to fix the lower end of the graft into the inlay below. Healed under one dressing and patient still in plaster cast.

Case 14.—Autogenous bone graft. Femur. Fracture femur, malunion, with angular deformity. C. D. N., Pvt., Co. C, 137th Inf. Home address, Waverly, Kansas. Date of admission, March 26, 1919. Date of injury, September 28, 1918, Argonne, France. *Diagnosis.* (1) Old compound comminuted fracture femur right (with 1 inch loss of substance), upper third, united in marked deformity with 2½ inches of overriding, upper fragment projecting outward and upward, lower fragment projecting inward and upward from callus uniting end of lower fragment with inner aspect of upper fragment, callus extending nearly up to lesser trochanter. (2) Osteomyelitis of fragments with large sequestra embedded at site of fracture. (3) Several suppurating bone sinuses extending from outer aspect to infected sequestra, one on anterior inner aspect of thigh leading down to fracture. (1, 2 and 3) Incurred while in action on Argonne Front, France, by machine-gun bullet, September 28, 1918. *Operation.* Incision (8-inch) over bone, external aspect of thigh, sinus dissected out. Periosteum divided, overriding fragments chiseled apart and ends resected and freed of mass of callus; then brought end to end (with leg brought out in abduction) and fixed with six screw Lane plates and put up in abduction in plaster cast. Wound packed widely open to be Dakinized. *Operator,* Lieut.

Col. Frank Martin, M. C.; Capt. Perry, M. C.; Lieut. Fields, M. C.

Case 15.—Autogenous bone graft. Tibia. L. A. T., Pvt., 476th M. Y. C. Age 21. Home address, Kansas City, Mo. Date of admission, March 5, 1919. Date of injury, January 9, 1919. Date of operation, March 7, 1919. *Diagnosis.* 1. Fracture, compound, comminuted, ununited, middle third, tibia, left. 2. Fracture, old compound, comminuted, partially united, upper third fibula, left. 1 and 2 result of motorcycle accident near Doulinge, France, January 9, 1919. *Operation.* Open operation. Sliding bone graft 3½ inches from upper fragment tied in place with kangaroo tendon. Cast applied. *Operator,* Capt. Adams; Capt. Brothers; Lieut. Hatch. *Remarks.* Reversed graft and speedy recovery followed. *Result.* Firm bony union has taken place with good function.

Case 16.—Autogenous bone graft. Tibia. J. E. W., Pvt., Co. B, 15th F. A. Age 22. Home address, Peasl, Mo. Date of admission, February 7, 1919. Date of injury, October 6, 1918. Date of operation, February 12, 1919. *Diagnosis.* Old fracture, tibia, lower third, left, compound, comminuted, ununited, with destruction of shaft for distance of 4 cm. Result of gunshot wound received in action on Champagne Front, France, October 6, 1918. *Operation.* Bone graft, sliding inlay taken from upper fragment, tibia. *Operator,* Lieut. Col. Frank Martin; Capt. Brothers; Capt. Witlach. *Remarks.* Incision in this case necessarily had to be made through some old scar tissue, due to the fact that he had large gutter wound of soft parts at site of nonunion. The wound healed primarily, but at lower end of scar tissue broke down superficially, and, although it did not infect the graft, there still is a small area unhealed, size of thumb nail. *Result.* Firm union has been established and graft is well incorporated in callus.

Case 17.—Autogenous bone graft. Tibia. C. B. K., 2nd Lieut., Co. B, 59th Inf. Age 35. Home address, Wakeeney, Kansas. Date of admission, January 17, 1919. Date of injury, September 29, 1918. Date of operation, January 23, 1919. *Diagnosis.* 1. Old fracture tibia right, junction of upper and

middle third with loss of 1½ inches of substance. 2. Osteomyelitis with many suppurating bone sinuses. 1 and 2 incurred in action near Mt. Faucon, France, September 29, 1918, by machine-gun bullet. Fibula intact and acting as splint for tibia. *Operation.* Sequestrectomy and the osteomyelitic ends of the fragments removed with Gigli saw, in order to bridge across and scaffold this gap, hoping that in view of the fact that the cavity had been so thoroughly cleaned, it would at least maintain separation of fragments, even if it did not form bone. The object of keeping the fragments separated was accomplished and the large cavity filled in quite promptly; but the graft did not live, but acted as a splendid piece of scaffolding and bone formed around it. The graft was later removed after being left in for many weeks. *Result.* The wound has practically closed and the ultimate result is undetermined as to whether another graft will be needed. It was considered almost certain that the graft would not be successful at time of operation because the culture taken then showed non-hemolytic streptococci. *Operator,* Lieut. Col. Frank Martin; Lieut. Hatch; Lieut. Buchbinder.

Case 18.—Autogenous bone graft. Tibia. W. A. M., Pvt., Co. D, 65th C. A. C. Age 22 years. Home address, Denver, Colo. Date of admission, January 27, 1919. Date of injury, August 28, 1918. Date of operation, January 28, 1919. *Diagnosis.* (1) Fracture, old, compound, comminuted, healed, tibia, lower third, right. Main line of fracture transverse, located 5 cm. above ankle joint. Another transverse line of fracture is located 10 cm. above ankle. Two fragments lie between these lines of fracture, one being in good alignment and the other displaced backward and upward. (2) Fracture, old, ununited, compound, comminuted, healed, fibula, right. Line of fracture 11 cm. above ankle joint. 1 and 2 accidently incurred August 28, 1918, in motorcycle accident at Toul, France. *Operation.* Bone graft, sliding inlay, tibia, right, cast applied. *Operator,* Lieut. Col. Frank Martin; Capt. Whitlatch; Lieut. Hatch. *Remarks.* In this case a long graft was cut from the upper to the lower fragment across the point

of malunion and the graft reversed. As alignment was good the gap in the bones was bridged well, by the reversed end of the graft and union took place rapidly. It emphasized the importance of having the graft good and long, because as is well known the ends of these bone fragments for 1½ inches have practically lost their osteogenetic function, and unless the scaffold is long enough to get well into healthy bone, ultimate union may not take place. *Result.* Excellent. Wound healed under one dressing, good bony union.

DISCUSSION

Dr. Fred G. Hodgson, Atlanta, Georgia.—I should like to ask Dr. Martin what method he uses for holding the graft.

Dr. W. R. Jackson, Mobile, Alabama.—I should like to ask Dr. Martin if he has had any suppuration after any of these transplants, and to what extent; if he had suppuration has he had union of bone?

Dr. Robert Carothers, Cincinnati, Ohio.—I hesitate to discuss this subject, although I should like to do so briefly. Those of us who have been interested in bone work did a good deal of it even before the war. We were doing industrial surgery before the war, such as factory and railroad injuries. The war has brought about a very considerable amount of work, much more than we have been able to do in a short space of time, and the reports we get are valuable for future work in industrial surgery.

There are several points in connection with this paper which might be considered, and one of them is the time at which the work can be done. If these cases can be seen very early, as in industrial work, and there is considerable destruction of bone, I do not see any reason why we cannot go ahead and fix the case up. We can. I have done it a number of times. There is always some infection, but that infection is not very great, and we will get union just the same.

I remember a young man who came to me with a peculiar injury. In some way or other the first metacarpal bone had been taken out as if operated on and lifted out, leaving the two ends and soft tissues which had been slightly or not at all injured, particularly the tendons. There was some destruction of the skin. Almost immediately after the injury I put an implant in there and got a most excellent result. In other words, the implant acted as a scaffolding until nature put in the bone and the implant disappeared, and the young man had a perfectly good result. If we do not see these cases early, that is, if some of these old ununited fractures present themselves, or something of that kind, it is wise to wait for a while before operating until a reasonable amount of the late infection has disappeared. We follow pretty much the same plan we do in nerve work in the regeneration of nerves, waiting a while until infection has disappeared, and then going ahead.

Dr. E. S. Judd, Rochester, Minnesota.—I have been much interested in Dr. Martin's paper. I have followed the work of Dr. Henderson, and he is doing practically the same thing as Dr. Martin. He feels that the bone graft is preferable to the use of a metal splint, and I think he is using it altogether in ununited fractures.

Dr. Joseph Ransohoff, Cincinnati, Ohio.—I should like to ask Dr. Martin whether he has had any fractures of the tibia from which he has taken bone grafts. The reason I ask the question is that recently I had occasion to see two cases, one of them a fracture of the skull, where a trephine opening had been made; there were some adhesions of the dura and cortex, and the boy had epileptic seizures, so that we removed and put in a bone graft from the tibia. This boy shortly thereafter had just slipped down in a hole and sustained a fracture of the tibia directy through the circular opening in the tibia with the line of fracture. The other case did not occur in my practice. Having seen two cases I think it would be strange if there were not others seen by other practitioners. I should like to ask Dr. Martin if he has had experience with other than bone grafts, such as casein clubs, made by Kocher, You can push them up in the proper place and implant them below. You can saw

them any length you want. I have had some nice results with them, and I have not taken them out. You have pieces of casein club staying between the two ends as a scaffolding.

Dr. Martin (closing the discussion).—What Dr. Ransohoff spoke about is incorporated in my article, but I did not read it on account of the time limit. The method of fixation in most cases is an inlay fixed with kangaroo tendon. I use it in practically all cases except where there was definite intermedullary fixation. In this case I was not able to get intermedullary fixation in both ends and preserve the length. The rest of them were done by ordinary inlays. Dr. Jackson asked about suppuration. Of these 22 cases there were 2 that failed. There was no suppuration in the successful cases. Infection kills a graft. I have never used the device to which Dr. Ransohoff has called our attention. I did not see any fractures of the tibia following bone grafting for the reconstruction work I did on the returned overseas cases.

I

ENDO-ANEURYSMORRHAPHY

I. STATISTICS OF OPERATION OF ENDO-ANEURYSMORRHAPHY
II. PERSONAL EXPERIENCES AND OBSERVATIONS ON THE TREATMENT OF ARTERIOVENOUS ANEURYSMS BY THE INTRASACCULAR METHOD OF SUTURE, WITH SPECIAL REFERENCE TO THE TRANSVENOUS ROUTE

By Rudolph Matas, M.D.
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STATISTICS OF THE OPERATION OF ENDO-ANEURYSMORRHAPHY

At different times I have published detailed statistics of the operation of endo-aneurysmorrhaphy in all its phases, the first systematic description being given in the *Transactions of the American Surgical Association,* in 1902, which included the first case operated upon by my method, dating back to March 30, 1888. The most complete report was presented to the Sur-

Note.—The spelling of the word "endo-aneurysmorrhaphy" as given in this article is in accordance with the classical orthography of the dictionaries. In revising the proof, Dr. Matas writes that he regards this spelling of the word as archaic and has personally abandoned it in favor of the contracted word "endoaneurismoraphy" which is equally descriptive and faithful to its Greek origin, but much simplified by the elimination of unnecessary consonants in accordance with the rules of the Carnegie Spelling Board.—Secretary.

gical Section of the XVIIth International Medical Congress, London, August, 1913, in which was included a detailed and classified account of 225 cases. This report was buried in the transactions of the congress and therefore received but little publicity. The list of operations and results up to December 31, 1915, presented at the Muetter Lecture, Philadelphia, increased the number of reported cases available for statistical purposes to 289. The diversion of professional interests created by the world war suspended the further collection of statistical material. Nevertheless, I have been able to add 28 new cases (chiefly personal and American) from July 1, 1916, to September, 1919, increasing the total list to 317 cases.

It has given me much pleasure to find that the method of intra-aneurysmal suture has been found very satisfactory in the treatment of war aneurysms, both arterial and arteriovenous, in the cases in which it has been applied. The method has been used by many foreign surgeons in the belligerent armies, who, though applying the intrasaccular suture on the principles which I and my co-workers have long advocated, have not always given credit to its American, or even its antebellum origin. I regret that, in spite of the numerous articles published, a lamentable ignorance is displayed, especially by foreign writers in regard to the underlying principles and simple technic of the methods of intrasaccular suture embraced under the term endo-aneurysmorrhaphy. I feel that it is due my many friends and to the contributors to the statistics of the operation that some account of the statistical progress be made. To this end a tabulated summary of the unpublished report which I presented at the Muetter Lecture in Philadelphia is given. This report does not include the group of cases which have accumulated since that date and to which I shall briefly refer after reading the table.

The total number of cases of endo-aneurysmorrhaphy reported up to December 31, 1915, at the Muetter Lecture, Philadelphia, including the 225 previously reported at the International Medical Congress of London, August, 1913, is shown in Table I.

TABLE I

Total cases up to December 31, 1915	289
Eliminating 6 cases—4 fatal inoperable aortic aneurysms and 2 accidental deaths, leaves a total of	283
Deaths	13, or 4.5 per cent.
Operative cures and recoveries	270, or 95.4 per cent.
Cases of gangrene	12, or 4.2 per cent.
Secondary hemorrhages	6, or 2.1 per cent.

Of 289 operations there were of the

	Cases.	Per cent.	Deaths	Per cent.	Gangrene.	Per cent.
Obliterative type	193	66.8	10	5.3	9	4.6
Restorative type	65	22.5	2	3.0	1	1.5
Reconstructive type	31	10.7	1	3.2	2	6.4

These operations cover all the large surgical arteries, including the abdominal aorta. Fully 86.1 per cent. involve the arteries of the lower extremity, including the external iliac; of the popliteal aneurysms there were 154 cases, or 53.2 per cent.; of femoral aneurysms, 61 cases, or 21.1 per cent., of the whole. If the popliteal group is selected as one of the most certain tests for all aneurysm operations, we find that it has been performed in all the three types of endo-aneurysmorrhaphy 154 times. Of these, 103 were obliterative operations followed by 6 cases of gangrene, or 5.2 per cent.; 2 secondary hemorrhages, or 1.3 per cent.; 2 relapses in the reconstructive group, or 1.3 per cent., one of which was cured by a secondary obliterative suture. In the 154 popliteal operations there was only one death, or 0.6 per cent. mortality, and 8 cases of gangrene, or 5.2 per cent. The total number of failures from all causes, including the 8 cases of gangrene, was 10, or 6.4 per cent. Five cases of gangrene occurred after the obliterative operation, 1 in the restorative group, and 2 in the reconstructive. The total recoveries as to life were 143, or 99.3 per cent., and the total operative successes as to cure of the aneurysm with good functional results as to life and limb, 93.6 per cent.

The results obtained by combining all the operations performed on the aneurysms of the lower extremity, including the external iliac, iliofemoral, femoral, popliteal and tibials, were,

up to January 1, 1916, in 246 cases, 230 cures and 16 failures, or 6.5 per cent. from all causes. Since January 1, 1916, up to September, 1919, the author records 28 additional cases, exclusive of a considerable number of operations performed during the war by foreign surgeons which have not been tabulated. Of these 28 endo-aneurysmorrhaphies, 17 were obliterative, 7 restorative, and 4 reconstructive. In these groups are included 7 aneurysms of the neck and upper extremities, 5 femoral, 16 popliteal, with 1 death which happened in an exsanguinated subject, operated upon *in extremis,* after rupture of an aneurysm. There were no cases of gangrene. There was one case of secondary hemorrhage following a catgut suture, cured by an obliterative operation with silk. These additional cases increase our total collective list to 317 endo-aneurysmorrhaphies up to September, 1919, of which 81 were performed in New Orleans and in the state of Louisiana, including 46 operations by the writer. These do not include 19 carotid, subclavian, innominate, iliac, and iliofemoral aneurysms, and cervical tumors requiring the extirpation of the common carotid, which were treated by the writer on the Halsted principle, either with the adjustable Matas-Allen aluminum band, applied proximally in the continuity of the vessel on the Hunterian plan, or by combining the band with the direct suture of the arteriovenous communication by the transvenous route. In all of these, complete operative cures were obtained, with the exception of 2 deaths from intercurrent or accidental complications (coronary heart disease and mesenteric thrombosis). These 19 cases do not include 16 additional applications of the band distally, or on the Brasdor plan, to the common carotid and subclavians, either simultaneously or consecutively, for the palliation of advanced aortic and innominate aneurysms, in which decided relief was obtained in approximately 30 per cent. of the cases. At this meeting 4 cases of endo-aneurysmorrhaphy were added by Gaston Torrance, of Birmingham, Alabama; 4 by A. C. Scott, of Temple, Texas; 1 by Shelton Horsley, of Richmond, Virginia, and 1 by C. C. Coleman, of Richmond, Virginia—in all 10 successful cases, which increases the total number to 327 cases operated upon by my technic.

II

PERSONAL EXPERIENCES AND OBSERVATIONS IN THE TREATMENT OF ARTERIOVENOUS ANEURYSMS

BY THE INTRASACCULAR METHOD OF SUTURE (ENDO-ANEURYSMORRHAPHY), WITH SPECIAL REFERENCE TO THE TRANSVENOUS ROUTE

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I. Renewed interest in the treatment of arteriovenous aneurysms has been roused by the great frequency of these lesions in the experience of the late World War. The coincident injury of the artery with its companion vein or with its satellites has long since been recognized by military experts as one of the most frequent and characteristic injuries of the blood-vessels in modern warfare. But the late war has exceeded the records of all previous wars in the frequency of vascular injuries, and especially those of the bivascular type. The increasing incidence of vascular injuries was foreshadowed by the records of the Balkan campaign in 1912-1913 which immediately preceded the World War; but even the incomplete contributions from the military surgeons of the belligerent armies which have appeared in the surgical literature during the last four years would indicate that the incidence of these injuries, and especially of the arteriovenous lesions, has exceeded by far

any forecast based upon the experience of previous wars.[1] This increase is accounted for by the great preponderance of the artillery and machine-gun fire, in which shrapnel, fragments of explosive bombs, shells, hand grenades, and the pointed bullet of the machine gun have had unprecedented sway as vulnerating bodies.[2] Some idea of the great frequency and im-

[1] Pirogoff, one of the greatest military surgeons, admitted in 1864 that he had never seen a single case of arteriovenous aneurysm that had been caused by gunshot wound, and this statement was in accord with the statistics of all the older wars. Thus we find Demme (1859), who served in the Italian campaigns, recorded 400 wounds of the bloodvessels without seeing a single arteriovenous aneurysm. In 74 cases of traumatic aneurysms no arteriovenous aneurysms were recorded in the American Civil War (1860–64); nor in the Russo-Turkish Wars (1877–78). During the Franco-Prussian War (1870–71), out of 44 traumatic aneurysms, only 8 arteriovenous cases are recorded on the German side. Bramman in his classic paper on arteriovenous aneurysms (1886) gives a brief description of 4 of these, which are included in his total of 157 arteriovenous aneurysms, 36 of which, or 40 per cent., were caused by phlebotomy. (E. Forgue, Rev. de Chirurg., Tome 54, ii, p. 1.) With the advent of the hard-jacketed, high-velocity projectile and small-calibre rifle, the history of war aneurysms begins as a conspicuous feature of warfare. Traumatic aneurysms, including the arteriovenous, became familiar injuries in the South African, Spanish-American Wars and in the Philippines. They figured still more in the Russo-Japanese War, and constituted nearly 2 per cent. of the total wounds in the Balkan conflict in 1913, which immediately preceded the late war.

[2] Chalier and Glénard (Les Grandes Blessures de Guerre, Rev. de Chirurgie, T. 51, January-June, 1916, p. 210) in an exhaustive study of 1500 wounded under their care at the front during November, 1914, to February, 1916, carefully recorded the nature of the vulnerating agent and found that a little over 50 per cent. of these were caused by rifle bullets, including machine-gun fire; and the artillery projectiles 42 per cent. (fragments of shells, 539; shrapnel, 73; caving in of trenches and shelters by bomb explosives, 16; and other causes attributed to artillery fire, 6, equals 634 cases, or 42 per cent.). Subsequently after the date of their publication they note that the proportion of artillery projectiles greatly increased as the war advanced. There were only 7 cases of bayonet wounds. Bier and Küttner make the same observation on the German side. In comparison, we find that in the Russo-Japanese conflict the casualties caused by small arms and bullets on the Japanese side were 83.5 per cent.; by artillery projectiles, 13.5 per cent. On the Russian side, small-rifle bullets caused 84.5 per cent. of the wounds; artillery and explosive projectiles, 14.5 per cent.

portance of these vascular injuries can be gathered from the fact that in a single British casualty clearing station, during the early days of the first battle of the Somme, there were 277 wounds of individual vessels which, according to Hey and Bowlby, required special treatments (Bowlby, *British Med. Jour.*, June, 1917, vol. i, p. 707). Okinczyc (*Jour. de Chirurgie,* 1917, vol. xiv, p. 441), writing of his experience with a French ambulance at the front, reports that 24.7 per cent. of the wounded required special attention for injuries of the bloodvessels, and that in 36 per cent. of these the injuries were multiple, involving usually the arteries and veins. Gerulanos on the German side (*Beitrag. z. klin. Chirurg.*, Bd. 93, 1914-15) reported that of 2522 wounded soldiers who were brought to him at the base, 50, or only 2 per cent., required special attention for gunshot wounds of the large bloodvessels. In the military hospitals at the base the effect of the first-aid treatment at the front and in the lines of communication at once lowered the proportion of gunshot wounds of the bloodvessels to about 2 per cent.

R. Solomon (*Beitrag. z. klin. Chirurg.*, 1918, vol. cxii, pp. 369-410), reporting the German experiences at Frankfort, in Rehn's Hospital, states that in a total of 25,000 wounded, 490, or 1.96 per cent., were admitted for gunshot wounds of the bloodvessels.

In regard to the increased frequency of the arteriovenous aneurysms, Sir George Makins (*Gunshot Injuries of the Bloodvessels,* London and New York, 1919), in an analysis of 272 traumatic (war) aneurysms, admitted to the London hospitals, found that 120 were arterial and 152 were arteriovenous; and that of the latter, 52, or a little over half, were simple or direct aneurysmal varices. He, in accordance with the majority of observers, finds that these bivascular or arteriovenous injuries occur with greatest frequency (at the base hospitals) in the carotid, femoral, popliteal, and axillary tracts—though at the front the tibial vessels are most frequently injured (26.6 per cent.), but as these occur coincidently with other complicating injuries (fractures) they are treated at the front and thereby eliminated from the base hospitals. The great excess of arterio-

venous injuries in the neck is shown by the fact that of 57 aneurysms, 10 were arterial and 47 arteriovenous, or about 80 per cent. arteriovenous. And of the latter, 49 were varicose and 18 aneurysmal varices. In the femoral group (common, superficial, and profunda), 170 injuries are recorded, of which 30 per cent. were arteriovenous. In the 41 recorded in the popliteal group, 20 were arterial and 21 arteriovenous. Of this group, 17 were varicose aneurysms and 4 aneurysmal varices.

Swan (1917) recorded 176 war aneurysms, of which 40 were arteriovenous, roughly 38 per cent. arteriovenous.

W. McAdam Eccles (1916) reported 50 traumatic aneurysms, of which 30 were arterial and 20 arteriovenous.

Soubbotich (1916), as the result of his large experience with the Serbian army, found a preponderance of arterial aneurysms. Of 126 aneurysms, 84 were arterial and 42 arteriovenous.

Bier reported, early in the war (1915), 102 aneurysms, of which 45 arterial and 56 arteriovenous were operated upon. The arteriovenous predominated in the femoral tract, where the proportion was 33 arteriovenous to 28 arterial.

Küttner (1916) states that, in his large experience, the relative proportion was 45 per cent. arterial and 55 per cent. arteriovenous.

Hotz states his proportion of arteriovenous as 70 per cent. of the total number.

In a general way, it may be safely stated that of the traumatic war aneurysms, fully 50 per cent. involve both the artery and the satellite vein, and furthermore, that in fully 50 per cent. of the arteriovenous aneurysms the communication established between the vessels is of the simple *direct* fistulous type (aneurysmal varices), and that in the remainder the wounded vessels communicate *indirectly* through a pseudo or adventitious sac.

It is well to note that while the great preponderance of artillery and explosive projectiles, fragments of shells, etc., has been responsible for the increase in the war wounds of the bloodvessels, it would appear that the greatest number of these,

and especially of the bivascular injuries (particularly the direct arteriovenous fistulæ), are caused by the small pointed rifle or machine-gun bullets.

In the neck, Makins found that in 60 recorded injuries of the carotid vessels, 22 were caused by bullets and 38 by fragments of shells or bombs, often of very small size, which were retained in the tissues or in the psuedo-aneurysmal sacs.

R. Solomon (1918) states that the pointed rifle bullet was responsible for 81 per cent. of the traumatic aneurysms observed in the Frankfort Clinic, of which 82.5 per cent. were through-and-through perforations, and 17.5 per cent. were complicated with retained missiles.

By reviewing the general (German) literature of the war, Solomon finds that 74 per cent. of the traumatic aneurysms were caused by rifle bullets, and in 14 per cent. of these the missile was retained. Shrapnel was the cause of the aneurysms in this author's series in 55 per cent., in 29 per cent. of which the missile was retained; in 11 per cent. of the aneurysms caused by fragments of grenades and bombs, fragments were retained in 57 per cent. Only 4 per cent. of the aneurysms were caused by punctured (bayonet, sword) wounds, and *contusions* were responsible for 20 per cent., though in the general literature, contusions are credited with only 1½ per cent.

Donati (1917), basing himself on a much smaller Italian experience limited chiefly to the extremities, estimates that 40 per cent. of bloodvessel injuries were caused by rifle bullets.

From all of which we gather that the largest number of aneurysms are caused by the small rifle bullet when it speeds through the tissues with high velocity, leaving only a clean-cut, tunnelled perforation. On the other hand, the fragments of shells or explosive projectiles of low velocity are *retained* in the tissues in about 57 per cent. of the cases.

* * * * * * *

II. It is not my purpose in this contribution to enter into a general discussion of the subject of arteriovenous aneurysms, or even attempt a systematic account of the methods of surgical treatment, especially as developed in the expereince of the

great war. Such an attempt would carry us far beyond the scope of this publication, which is intended to renew attention to the frequency and growing importance of a vascular injury which has become more than ever one of the most conspicuous features of the surgery of modern warfare.

I have, elsewhere, treated this very interesting lesion in its manifold and general phases (see Vascular Surgery, Chapter lx, vol v, Keen's *Surgery*) and have dealt more fully with the developments consequent upon the vast experience of the late war in a general review of the war surgery of the heart and bloodvessels, which is to appear in a forthcoming supplementary volume of Keen's *Surgery,* now in press.

My object in this paper is to give a brief account of a group of personal experiences which illustrate the practical application of the intrasaccular method of suture, which I have so long devised and advocated for the cure of arterial aneurysms (endo-aneurysmorrhaphy), and found equally advantageous in the cure of the most frequent types of the bivascular or arteriovenous aneurysms.[1]

III. There is no single method or technic that is applicable to all varieties of arteriovenous aneurysms as these are met in practice. There are, and always will be, cases in which the conservative principle of the suture, which aims at the restoration of the functional integrity of the bloodvessels, will have to yield, in the presence of insurmountable and forbidding anatomical and pathological conditions, to the radical methods of ligation and extirpation, which are to be regarded as conservative whenever they accomplish their purpose (cure) without sacrifice of limb or life. But the experience of the author confirms the opinion that by the adoption of new technical suggestions, such as exhibited in this paper, the opportunities for the application of a conservative technic can be much enlarged, thereby reducing very considerably the number of radical ligations and extirpations which are undoubtedly performed with

[1] Much of the text which follows is a transcript of an article contributed to the Osler Anniversary Memorial Volume, and is here reproduced by permission of the Editors.

unnecessary frequency and severity in the current practice of the day.

It would be well to premise a further consideration of this subject by stating that in dealing with the later suggestions presented in these personal experiences, we have in mind the treatment of the fully formed or established types of the mature arteriovenous lesions as distinguished from the primary or recent wounds of these vessels, when the question of primary hemostasis for hemorrhage or the relief of rapidly spreading hematomas is the first consideration. Even in these, the principle of conserving the functional integrity of the injured vessels is to be seriously considered, and can be successfully met, in many instances, by the devices of conservative practice —such as end-to-end suture of the vessels, vascular grafts and intubation with paraffined glass or metallic tubes (Brewer's, Tuffier's, Lespinasse's and others). But the technical problems are very different from those offered by the mature or established arteriovenous aneurysms, with which we are now concerned.

* * * * * * *

If we were to study closely the morphology and pathological anatomy of the mature and fully established arteriovenous aneurysms, we would probably be able to differentiate more than fifteen varieties. These, however, can be grouped about the two fundamental types, which have been classical since the days of Hunter and Scarpa. These are the *aneurysmal varix* (varix aneurysmaticus) and the *varicose aneurysm* (aneurysma varicosum). The aneurysmal varix, with its subvarieties, typifies the *direct* mode of arteriovenous anastomosis; the varicose aneurysm, the *indirect* communication between the two vessels, through a common intermediary or "communicating" sac. In the aneurysmal varix the arterial and venous wounds become agglutinated and adherent as a direct inosculation, following as an immediate or early sequel of the injury and an arteriovenous fistula is established after the small perivascular extravasation has been absorbed. Two important subvarieties of this type must be distinguished: (1) The true aneurysmal varix

which presupposes a varicose dilatation of the vein, constituting the true sac of the aneurysm, and which, owing to the progressive dilatation of the vein, may attain enormous proportions, not only at the seat of the anastomosis, but in older cases, far beyond the proximal and distal sides of the abnormal communication, owing to the yielding and incompetence of the valves; and (2) the simple arteriovenous fistula (*phlebartery* of Broca) in which there is no varicose dilatation except a general symmetrical enlargement or ampullar formation of the vein at the site of the fistula, where the dilatation is confined by the resistance of competent valves.

In the *varicose* aneurysm, *as classically described,* the normal anatomical position of the vessels is disturbed; they do not lie side by side as in the aneurysmal varices. The injury is followed by more or less extensive hemorrhage, which, being circumscribed by the resistance of the perivascular tissues, forms a well-defined pulsating hematoma and finally an encysted and clearly differentiated and well-walled sac, which is lined with endothelium continuous with that of the open mouths of the bloodvessels.

As above stated, it is customary to describe a varicose aneurysm as an intermediary pseudo-sac formed adventitiously and interposed between the injured vessels, through which an indirect communication is established between the artery and vein. But contrary to this teaching all surgeons of experience will agree that the formation of this *intermediary* sac is an exceptional occurrence, whereas the presence of a well-defined sac into which the injured vessels open *separately* without any disturbance in their anatomical relations—the two vessels lying side by side—is a common occurrence. On opening such a sac and evacuating the clot, the two vessels will be seen at the bottom or at some part of the periphery of the cavity, plainly in relief, or faintly outlined under the fibroendothelial capsule, which, in old aneurysms, covers them like a veil. The orifices indicating the original seat of injury will show themselves in various ways; either as elliptical or slit-like openings lying parallel to each other, or in a quadruple group, two proximal

and two distal, separated by an interval of variable length. The proximal orifices represent the cardiac and the distal the peripheral ends of the divided vessels. These different appearances depend upon the extent of the primary injury—whether a partial or a total division of the vessels is involved in the trauma. In some rare cases in which the vessels have been completely divided, there are, as Amussat first observed, only two recognizable openings leading into the sac, one for the artery and one for the vein, which indicate the cardiac or central ends of the divided bloodvessels, the peripheral ends having been occluded by organized thrombi and finally lost in the wall of the sac. It is more frequent, in our experience, to see a type of varicose aneurysm, following partial division of the vessels, in which there is a common, fairly large sac, which when opened exhibits a smaller pocket formed by the sheath of the vessels. In the center of this smaller cavity four orifices appear in close proximity, showing that the vessels have been injured tangentially and simultaneously, either by stab or shot, causing no disturbance in their relations as they lie side by side in perfect apposition. The four orifices lie parallel to each other, two above and two below, and open directly into the smaller sac formed by the sheath which has been torn open, leaving a circular or elliptical opening which merges in its contour with the larger pseudo-sac formed by the primary hematoma (Figs. 2 and 3, illustrating the case of Walter E.).

The margins of the orifices in all types of arteriovenous aneurisms of mature formation (six or eight weeks and over) are usually thick and smooth and are covered by a glistening endothelium which merges and is continuous with the endothelial lining of the cyst-like cavity of the sac. The same blending or merging with the endothelial lining is observed in the fistulous communications existing in the direct arteriovenous lesions; a matter of importance, as this thickened and firm lining offers an excellent grip for the sutures which obliterate the anastomotic communications.

Another and most troublesome, but rarer, type is the arteriovenous aneurysm in which the artery has been injured simul-

taneously with its two satellite veins. In these cases a venous sac or ampulla is formed on each side of the artery. The two venous sacs are usually asymmetrical, according to the different planes of resistance encountered in their development, one of these attaining large proportions and the dimensions of the other being only moderate.

In stab of punctured wounds the adventitious or common sac lies, usually, in front of the vessels, and in the gunshot wounds the sac more often lies behind them.

The following diagrams (Fig. 1), modified from Sir George Makins's *Gunshot Injuries of the Bloodvessels,* 1919, give a clear idea of the relations of the bloodvessels to each other and to the adventitious sac, as they would appear on cross-section. They are in perfect accord with the clinical findings, not only as carefully studied in "war aneurysms" by Makins, but with the morphology of these aneurysms as observed by the writer in his civilian experience.

In other still rarer cases, more often met in civil practice (hunting accidents), and fortunately limited, usually, to the peripheral vessels of a secondary order (upper extremity), are those in which an artery of smaller magnitude is injured simultaneously with its venæ comites at many places by fine shot. In these cases, the condition imitates cirsoid aneurysm, and the arteries and veins are mixed up in such inextricable confusion that extirpation is the only remedy; fortunately, they seldom attain dangerous proportions or cause serious disabilities and can be safely allowed to remain undisturbed.

Arteriovenous aneurysms with an *arterial* sac, in which the aneurysm ruptures secondarily and pathologically (not traumatically) into a vein, is so great a rarity in surgical practice that it can well be relegated to the domain of pure pathology. It is practically only observed in the thorax as a result of pathological conditions beginning on the arterial side (aortic aneurysm opening into the vena cava, etc.).

IV. Personal Experiences with the Suture of Arteriovenous Aneurysms. In a personal experience of over 204 surgical interventions upon the large bloodvessels, I find the

record of 24 cases of arteriovenous injuries of various types. In this group I have utilized the principle of endo-aneurysmorrhaphy in 12; viz., common carotid, 1; external iliac, 1; the common and superficial femoral, 8; the peroneal vessels, 1; the subclavian, 1. All of these have made good recoveries, except the carotid aneurysm, in which death occurred on the eighth day after the operation from coronary disease and pulmonary clot; and, in the iliac aneurysm, in which death occurred from mesenteric thrombosis and gangrene of the bowel caused by prolonged compression of a loop of bowel by a powerful Doyen retractor which had been used in an extensive subperitoneal dissection to expose the iliac vessels. In neither case, as shown by autopsy, was the technic of the operation, as far as the vessels were concerned, responsible for the fatal termination, as the condition of the wound was found to be faultless. In the subclavian case, operated on September 3, 1900 (a young white farmer, aged twenty-four years), the artery, which had been perforated with a bullet in the second division, immediately behind the anterior scalene, had to be ligated on each side of the muscle; but the vein, which was surprisingly small, was sutured. The patient recovered but lost parts of his hand from arterial ischemia and necrosis. In this case the operation was performed only two weeks after the injury and illustrates the importance of the time element in developing the collateral circulation.[1]

Lateral Angiorrhaphy in Arteriovenous Hematoma. In another case a man aged twenty-six years, operated at the Touro Infirmary on May 3, 1907, suffered a gunshot wound involving the femoral vessels in Hunter's canal and was operated about six weeks after the injury by separate lateral suture of each one of the orifices, leaving the lumen of each vessel pervious. The patient made an excellent recovery, with perfect functional result to the limb, notwithstanding his deplorable con-

[1] This case is fully reported by the author in a paper on "Traumatic Arteriovenous Aneurysms of the Subclavian Vessels" in the Transactions of the American Surgical Association, 1901, and in the Jour. Am. Med. Assn., January 11, 1902.

dition from many wounds, including multiple fractures of the lower jaw, which he had received in quelling a negro riot at Liberty, Miss. This procedure represents probably the oldest and undoubtedly the best known of the conservative operations that have been applied for the cure of arteriovenous aneurysms and is an ideal method when it can be carried out. The experience of the present war has added a large number of such cases to the early list of pioneers: Z. von Manteuffel (1895), femoral vessels; Cammagio (1898), femoral vessels; Gérard Marchant (1898), brachial vessels; Peugniez (1900), brachial vessels; Matas (1900), subclavian vessels, and to those of other civilian and military surgeons who had availed themselves of the progress in vascular suture long before the late war.

The Obliterative Suture in Arteriovenous Aneurysm of the Varicose Type with Communicating Pseudo-sac. Another case, operated on March 9, 1912, was that of Walter E., a youth of eighteen years, from Wesson, Miss., who had been accidentally stabbed when twelve years old, with a long pocket knife, in the upper femoral region. He had developed an arteriovenous aneurysm which involved the common femoral vessels at the apex of Scarpa's triangle, close to the origin of the profunda. In view of the long duration of the aneurysm and possible necessity of doing an obliterative operation, the boy was kept under careful observation for two weeks before the operation. During this time he was fed abundantly and given digitalis systematically, in the hope of increasing his blood-pressure which was scarcely ever over $^{11}\%_{65}$. Frequent tests were made of his collateral circulation, which showed that the living color returned to the limb after Esmarch ischemia, while the common femoral was compressed. The living color returned in about five minutes, but just before the operation the time had shortened to three minutes. Feeling that a good collateral circulation had been established, I undertook the operation, believing that if it became necessary an obliteration could be performed without risk to the limb. The operation was performed under ether, at the Touro Infirmary, on

March 9, 1912. The incision, directly into the sac, revealed a large well-lined cavity which was at first taken to be the dilated femoral vein, but which was subsequently interpreted as a pseudo-sac well lined with endothelium which opened directly into a lesser pocket of oval shape, measuring about two inches in diameter (Figs. 2, 3, 4 and 5). At the bottom of this could be seen four separate orifices, each large enough to admit the tip of the little finger and grouped into a quadrilateral, the two openings on the inner side corresponding to the distal and proximal orifices of the femoral vein and the two outer to those of the artery. A ridge or linear induration indicated the original septum of the sheath which separated the arterial from the venous compartment, but the edges of the orifices were continuous and blended with the septum and with the smooth glistening endothelial surface that lined the interior of the sac. Each one of these orifices was now sutured separately with fine paraffined linen, leaving them completely sealed and obliterated. Then all communications leading from the large vessels to the sac were closed. The sac, which was very densely incrusted all over its walls with calcareous deposits in plaques, was only cleared of these incrustations by prolonged scrubbing with saline solution and gauze sponges. In the main cavity, which formed the bulk of the aneurysm (size of a small apple), a mass of phleboliths was found in the midst of the red clot. After the toilet of the sac had been completed, this was obliterated partially by bringing the sac walls in apposition with continued rows of fine chromic gut sutures, in the manner shown in Figs. 4 and 5.

The blood-pressure before the operation (9.40 A. M.) was 110 S.; during the operation it rose to 120 S., and at the close of the operation (10.25 A. M.) it fell again to 110 S. At the close of the operation the Esmarch constrictor, which had been applied high up in the groin, was removed and was followed, in less than one minute, by a return of a good living color throughout the extremity to the tip of the toes. At 10.35 A. M. the dorsalis pedis and posterior tibial could be felt beating distinctly in the foot. Evidently the preliminary tests of the

collateral circulation had told the truth, and the results confirmed our confidence in their value, and justified the obliterative operation which we had adopted.

The records show that the wound healed *per primam*. It was inspected on the fourth day. An ulcer which had existed in the leg as a consequence of the varicosities healed rapidly, and the boy was discharged and returned to his home on March 29, nineteen days after the operation, with his ulcer healed, a notable reduction in the varicosities, and perfect functional use of the limb.

Since the day of his discharge I have seen the boy repeatedly, and in my last examination, one year ago, there was no trace of the aneurysm, and only a linear scar indicated the site of the operation. The varicosities along the saphenous tract had subsided, the ulcer had remained healed, and even the pigmentation which had darkened his leg had paled. He was working on a farm and doing hard labor as a field hand.

This case illustrates not only the simplicity and safety of the technic of the intrasaccular suture in its *obliterative* phases, but its successful application to a type of varicose aneurysms which is not infrequent and could be made quite formidable if attacked by followers of the methods of either one of the extreme and divergent schools of vascular surgery—the ultra-conservatives, represented on the one hand by the German followers of Lexer (in the early stages of the late war), who believe it their duty to do the so-called "ideale" operation in every case in which it was feasible, and who, taking this case as an example, would have systematically extirpated the sac, dissecting out the vessels from their bed and attempted to do an end-to-end suture of both vessels,[1] and, on the other hand, the

[1] Early in the war, Bier, Küttner and other leading operators soon abandoned the extirpation of the sac in mature aneurysms as superfluous and unnecessarily traumatizing, and, in addition, dangerous to the collaterals—and this got rid of one of the most objectionable features of the Lexer procedure. In lateral wounds, amounting to about 50 per cent. of the cases, they simply did an intrasaccular suture of the orifice of communication, precisely as I do a restorative endo-aneurysmorrhaphy

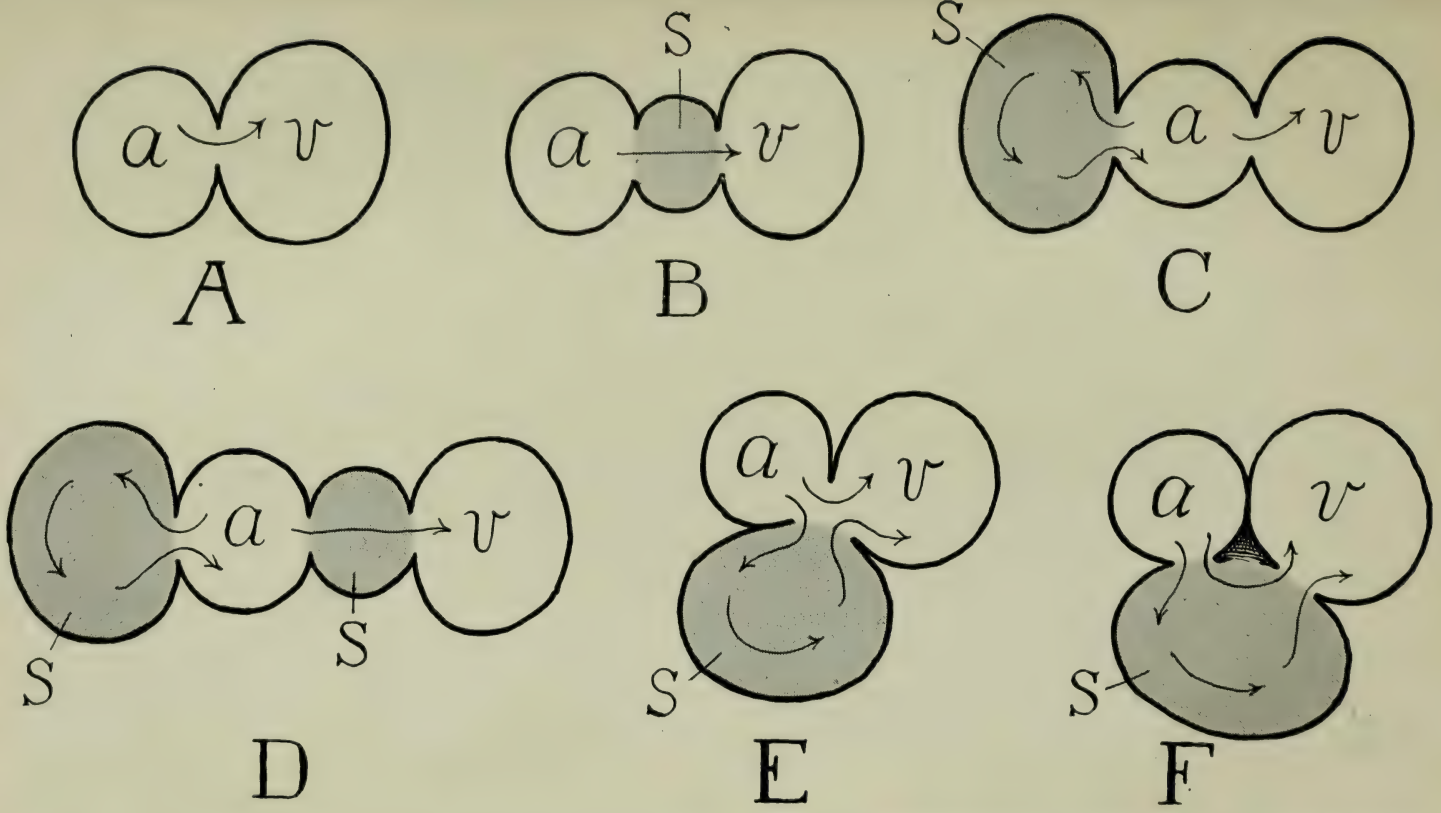

FIG. 1.—*A*, simple aneurysmal varix. *B*, arteriovenous aneurysm (so-called varicose aneurysm), sac interposed. *C*, arterial aneurysm combined with aneurysmal varix. *D*, arterial and arteriovenous sac. *E*, arteriovenous sac with common opening of communication with artery and vein. *F*, arteriovenous sac with separate openings of communication with artery and vein. (Modified from Makins.)

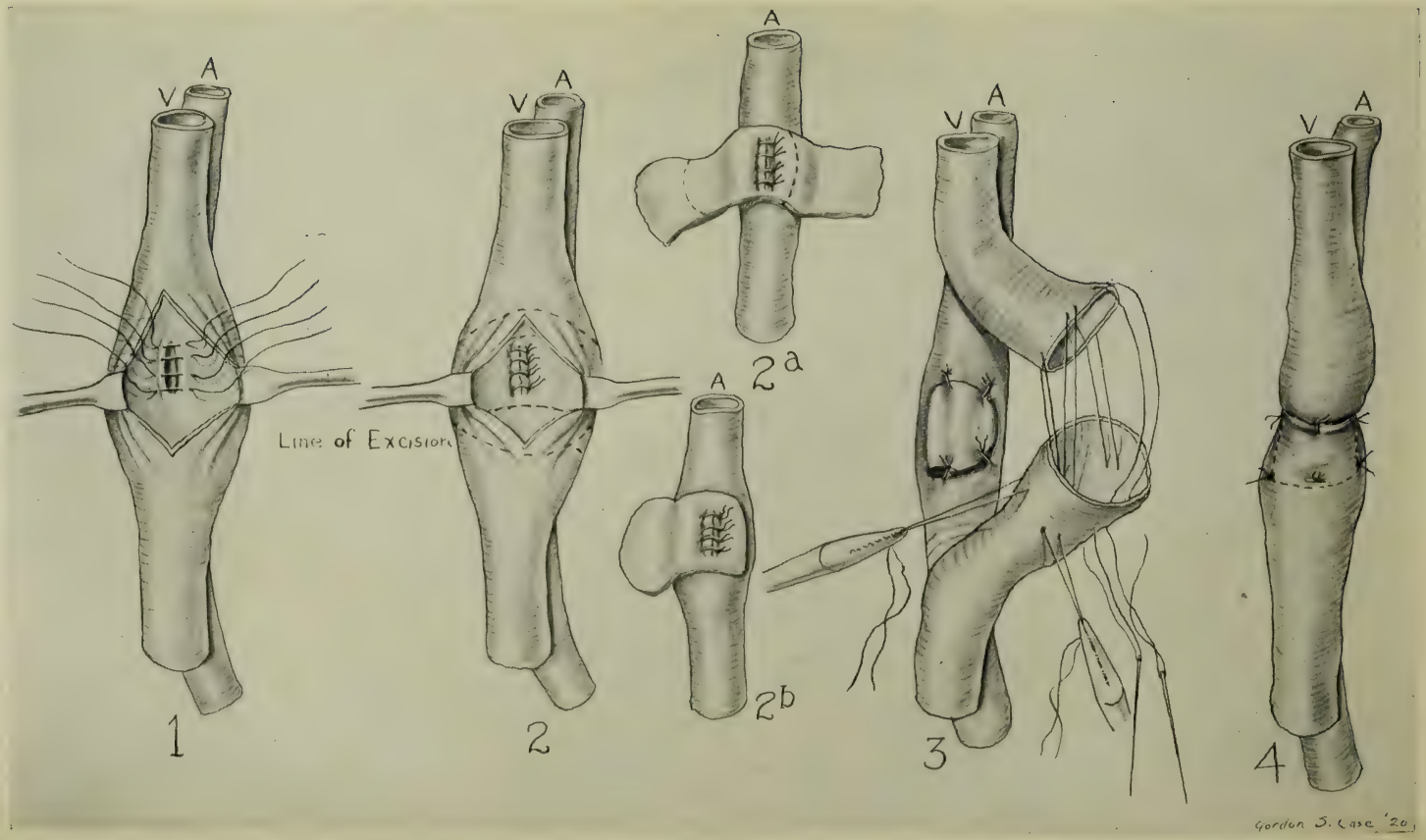

FIG. 6.—One of the methods of closing an arteriovenous fistula(aneurysmal varix), by the transvenous route (Matas-Bickham procedure), modified by Dr. J. Chalmers Da Costa (Philadelphia, Pa.). See opposite page for explanatory note.

The diagrams (drawn from description) shown in Fig. 6 illustrate the procedure successfully adopted by Dr. J. C. Da Costa in the treatment of an aneurysmal varix of the popliteal vessels. (*Annals of Surgery*, 1912, vol. lv, pp. 592–597).

1. Longitudinal incision of the vein. Exposure and suture of the opening into the artery from within the veins.

2. The fistulous opening closed, the knots tied; dotted line of incision indicated to show extent of the circular resection of the vein.

2*a*. Flap of vein remaining attached to artery and sutured openings, lines indicating the extent of the paring of the venous flap.

2*b*. The venous flap reduced by paring remains adherent to the arterial wall with the movable flap ready to be turned over as a hinged cover to reinforce and protect the line of arteriovenous suture.

3. The venous flap is shown folded over the line of suture where it is held by a few interrupted sutures. The resected and dilated vein is shown in the act of invagination, with the transfixion sutures *in situ*, ready to telescope the proximal into the distal end. As a rule, the distal end should be invaginated into the proximal (cardiac) end in accordance with the direction of the venous current to diminish the friction of the blood stream against the cut edges—this should favor better apposition of the venous walls and also diminish the extent of the protecting parietal thrombus. It is also the rule of practice, at the present time, to unite the venous segments by the continued Carrel suture of the margins with confrontation of the endothelial surfaces, rather than by invagination by the Murphy method, which is now obsolete.

4. The venous anastomosis completed and the continuity of both vessels (artery and vein) restored with complete closure of the fistula.

In this procedure Da Costa found it necessary to modify the original Matas-Bickham procedure by cutting out circular section of the vein and utilizing this as a flap to cover and reinforce the line of arteriovenous suture, as shown in Bickham's diagrams (*Annals of Surgery*, May, 1904). The patch of the venous wall through which the fistula has been closed is alone excised and allowed to remain *in situ*, attached to the artery, and the oval gap remaining in the vein is closed from without by a continued suture. The longitudinal incision through which the fistula is closed is also sutured, and in this way the lumen of the vein is completely restored. Usually the vein is abnormally dilated and a plastic patch can be excised from its walls and the remaining gap sutured without constricting it unduly. In Da Costa's case the caliber of the vein had been so considerably reduced by the transvenous suture that he deemed it necessary to do a circular resection, as shown in the diagram, and the result was excellent.

[I have taken the liberty to substitute the present drawings for those which accompany Doctor Da Costa's original paper, believing that these will make the details of the procedure more intelligible.—R. M.]

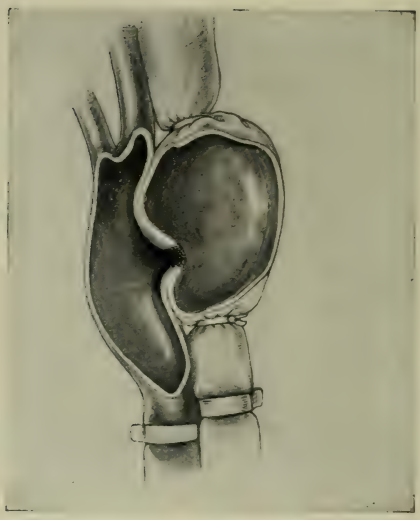

FIG. 11.—Diagrammatic representation of the arteriovenous communication between the carotid vessels in the case of John G. (jugulo-carotid aneurysm).

ultra-radicals, represented by the French school of surgeons, who, following the lead of Delbet, extirpate the sac together with its vascular contents and then ligate the four stumps by the quadruple ligature.

Between these stand the intrasaccular ligaturists of the British and Japanese schools, who do far less damage to the perivascular tissues, but who, none the less, give themselves unnecessary worry and complicate their technic by dissecting out the main vessels and their collateral branches in order to close them by the quadruple ligature.

It is possible that by any one of these methods this aneurysm would have been cured and the limb saved, because in this case it had been clearly demonstrated that the collateral circulation had been established and that reconstructive procedures were unnecessary. But why undertake a laborious and, at best, the uncertain circular angiorrhaphy, as in the so-called "ideale" operation, or subject the patient to the unnecessary trauma of an extirpation of the sac with its waste of good vascular material? Or, again, why insist upon the extrasaccular dissection by the quadruple ligature, when the simple obliteration of the orifices in the sac can be so often easily accomplished with the suture and with so much economy to the bloodvessels? Why not endeavor to attain the objective

circular suture, leaving the sac intact. Küttner has gone much further than his contemporaries in utilizing attached sac flaps to patch extensive wounds of the arteries which were too large to allow of lateral arteriorrhaphy, thus avoiding whenever possible the necessity for a circular suture. In this way he has also utilized the principle of sac repair and arterial reconstruction far beyond the original scope contemplated by the writer in his reconstructive endo-aneurismorrhaphy. As a rule, in such extensive perforations I would apply the obliterative intrasaccular suture after testing the efficiency of the collateral circulation by previous tests. In the course of the war the majority of German surgeons have virtually abandoned the method of grafting a venous segment to bridge the gap between the divided sections of the artery. They have found that this procedure did not justify by its results the time and labor expended in its performance. At any rate, it is largely recognized as a failure from the point of view of the practice of military surgery.

aimed at by the elementary and safe technic of the endo-aneurysmal suture?

I could easily add to the testimony offered by the preceding case by a number of clinical experiences which prove the simplicity and reliability of the endo-aneurysmal suture in the many phases of *varicose* aneurysm in which the *obliterative* principle is indicated. Apart from my own experiences I could quote a number of confirmatory reports from the practice of my associates and other local surgeons (Doctors Gessner, Parham, Maes, Danna and others) who have adopted the endo-aneurysmal suture and successfully applied it in the treatment of arteriovenous lesions.

But I must proceed with the treatment of the most familiar type of arteriovenous injury, the *aneurismal varix* or fistula, which has furnished me with the largest and most varied experience in nine cases, in all of which I have applied the principle of endo-aneurysmal suture in its *restorative phases,* with a success that could scarcely have been obtained by any one of the conservative or radical procedures in vogue.

In order to approach this subject more intelligently, a brief reference to the historical evolution of the special modification of the endo-aneurysmal method as adapted to the peculiarities of *aneurysmal varices* is necessary.

V. *Endo-aneurysmal Suture by the Transvenous Route.* In the *Annals of Surgery* for February, 1903, I published my first systematic account of the endo-aneurysmal method of suture which I had first applied to a brachial aneurysm on March 30, 1888 (*Medical News,* Philadelphia, October 27, 1888).

My paper dealt with arterial aneurysms and not with arteriovenous lesions, though the indications for the suture in these cases were obvious. This gap in the technic, however, was quickly filled by my friend and former associate, Dr. W. S. Bickham, of New York, who in an excellent paper published in the *Annals of Surgery* for May, 1904, suggested and elaborated a most ingenious technic for the application of the intrasaccular suture to the various lesions grouped together under the name of arteriovenous aneurysms.

The methods suggested and so clearly illustrated by Bickham in 1904 will be found more systematically described in his excellent *Text-book of Operative Surgery* (third edition, Saunders, 1908), under the heading of "Operations for the Radical Cure of Arteriovenous Aneurysms with Preservation of the Circulation in the Artery and Vein: The Matas-Bickham Operation."

Bickham's foresight and planning of this technic which was based upon the theoretical possibilities offered by the most familiar types of arteriovenous aneurysms are, indeed, most remarkable and praiseworthy.

The first clinical application of one of Bickham's suggestions, viz., to attack the problem of closing the fistula in aneurysmal varix by the transvenous route, was first demonstrated clinically by my friend and associate, Dr. H. B. Gessner (*N. O. Medical and Surgical Journal,* vol. lx, 1907-8, pp. 553-556), in the case of a colored laborer, aged twenty-two years, who had sustained a gunshot injury (multiple small shot) in the abdomen and right thigh. The injury had been inflicted eleven years previously and involved the femoral vessels in Hunter's canal. The injury had caused comparatively little disturbance. The operation was performed on May 30, 1908. The sac itself was small and, notwithstanding the long duration of the injury, there were none of the varicosities or trophic changes in the skin of the lower extremity which characterize the progressive types of varix aneurysmaticus. The thrill and murmur caused the patient anxiety and this was the chief reason for the intervention. In this case the sac was formed by ampullar dilatation of one of the venæ comites, the other being intact. Three arteriovenous fistulæ caused by small shot were discovered in the interior of the venous sac when this was opened. They were all closed by separate intrasaccular sutures and the artery left undisturbed. The sac itself was folded and obliterated by suture.

The endo-aneurysmal suture by the transvenous route was also utilized for the cure of aneurysmal varix by Dr. J. Chalmers Da Costa of Philadelphia (*Annals of Surgery,* vol. lv,

pp. 593-597, 1912). The operation was performed on October 22, 1910.

The patient, a young woman, aged twenty-nine years, had been shot accidentally three months before the operation in the left popliteal space, with a No. 22 caliber bullet. Under ether, and after preliminary hemostasis with Esmarch constrictor, the popliteal vessels were exposed and a longitudinal incision was made on the outer side of the vein. The fistulous opening which connected the two vessels was readily exposed and closed from *within* the vein with a No. 0 iodized catgut. On tying the sutures it was found that so much of the venous wall had been drawn in by the stitches that the caliber of the vein was greatly reduced. The vein was, therefore, divided transversely on each side of the point of fusion to the artery and a flap was cut out of the excluded venous segment and superimposed over the suture line in the artery and sewed to the artery by interrupted catgut sutures. Thus a flap of the vein was used to strengthen the line of suture at that point. The flap was about one inch in length. The two ends of the vein were then brought together by invaginating the upper (narrower) end into the larger (lower) end and fixed with four transfixion sutures, the line of junction being reinforced by a few catgut sutures passed through the external coat. The tourniquets were now removed and the blood jumped into both vessels, flowing through their respective channels, the artery pulsating vigorously and without a bit of leakage. The patient made an uneventful recovery. In a month she walked naturally (Fig. 6).

This very interesting case shows how the technic of a transvenous arteriorrhaphy or endo-aneurysmorrhaphy can be ingeniously modified to meet the requirements of a conservative practice without affecting the fundamental principle involved in the procedure.

Another interesting illustration of the successful application of the transvenous method of closing an arteriovenous fistula by suture with the preservation of both vessels is furnished in the report of an aneurysmal varix of the popliteal vessels, oper-

ated upon by Dr. William Pearson, surgeon to the Adelaide Hospital, Dublin, under the title of "Transvenous Aneurysmorrhaphy" (*British Medical Journal,* June 14, 1910, pp. 736-737).

The operation was performed on January 15, 1917, on a soldier aged twenty-two years, who had been wounded with a rifle bullet on October 11, 1915 (nearly seventeen months before the operation). The popliteal vessels were exposed in the upper part of their course, where the artery and the vein were firmly adherent to one another without any intervening sac. Here the vein was greatly dilated and the artery below was considerably smaller than usual. When freeing the side of the vein from its connection with the artery a saccular venous aneurysm was exposed (see Fig. 7) and was removed, disclosing the arteriovenous stoma through the lumen of the vein. It was of an elongated elliptical form, one-half inch in length, and lying in the long axis of the vessel. The opening in the vein was enlarged very slightly upwards and downwards, and through it the aneurysmal opening was sutured with a fine silk sterilized in liquid paraffin. The vein was then closed by continued suture. On removal of the tourniquet there was no bleeding, and the circulation through the vessels seemed perfect. The operation was completed by suture of the fascial tissue and the skin.

After the operation good pulsation was felt in the dorsalis pedis and posterior tibial arteries. On the following day there was no trace of edema in the limb; the color was normal and the dilatation of the superficial veins had disappeared. Healing was uneventful, the circulation remained good, and the patient was allowed to walk four weeks after operation. He was kept under observation for two months and then discharged to light duty, the circulation being normal.

This case presents several unusual features apart from the technic employed to cure the aneurysm—which can only be referred to in a cursory way, as the operative phase of the case is what concerns us in this paper. The fact that a distinct aneurysmal sac formed opposite the fistula at the expense of

the venous wall is rare; a general dilatation of the vein, often attaining enormous proportions, is common in old aneurysmal varices, but a well-defined venous sac springing in an isolated fashion, as in this case, is not so frequent. When it exists, it lends, for obvious reasons, additional advantages to the transvenous method of suturing the orifice of communication. The fact, also, that in this case no signs of arterial varix developed until massage was applied to the limb, three months after the injury, is also instructive and justifies the opinion previously expressed by Pearson, that massage has proved an exciting cause of the rapid development of previously latent traumatic aneurysms in certain gunshot wounds of the bloodvessels.

The care taken by the author to avoid injury to the endothelium of the vein while exploring its interior as a preliminary to the transvenous suture by irrigating with warm saline instead of wiping the interior of the vein with gauze to clear the fistulous origin, and spraying with liquid vaseline, shows his appreciation of the dangers of thrombosis from rough swabbing of the endothelium.

But the method of introducing the suture to close the arteriovenous communication is most important. The needle is first passed through a small portion of the fibrous tissue which binds the vessels together at one end of the communication, on its external aspect (that is, entirely outside of the vessels and between the two), and does not penetrate the intima of either —it thus resembles the commencement of the outer row of sutures in a gastro-jejunostomy. This stitch is immediately tied and the needle is then passed obliquely from without inwards, emerging on the inner surface of the vein, close up to the extremity of the stoma (Fig. 7). The extreme edges of this are then brought together by fine continuous suture through intima and media until the opposite end is reached, when the needle is again passed out from the lumen of the vein obliquely through its wall and the overlying tissue which binds it to the artery, so as to emerge between the two, when it is secured in a similar manner to the other end.

Thus it will be seen that there is no knot projecting in the

lumen of either vessel, and if the stitches are placed accurately and drawn taut throughout, they do not present in the lumen of either vessel any more than in the case of ordinary through-and-through sutures. The closure of the incision in the vein presents no difficulty, being effected by continued suture which brings the opposed endothelial surfaces in confrontation. The result obtained by Pearson in this case is most gratifying, as it confirms the value of Bickham's excellent suggestion and my own personal experience with the transvenous method of aneurysmorrhaphy in the treatment of aneurysmal varices.

It is noteworthy that the technic described by Pearson, and which he appears to have worked up independently, is identical in principle and almost in every detail with that described and illustrated by Bickham in the *Annals of Surgery* for May, 1904, and in his *Operative Surgery,* third edition, 1908, p. 136, under the title of the "Matas-Bickham Operation," and also reproduced in my chapter on Vascular Surgery of Arteriovenous Aneurysms, Keen's *Surgery,* 1909, vol. v, pp. 308-909, where the identical method of passing the obliterative suture from without inwards, leaving no knots in the lumen, is shown in Fig. 104.

What is more important is to remember that, while the approach to the arteriovenous communication in aneurysmal varices is accomplished by opening the vein, and the closure of the fistula is obtained by the suture of the orifice through the *interior* of the dilated vein, as the essential features of the method advocated by Bickham and myself—the final disposition of the vein will vary according to the anatomical conditions revealed in the course of the operation.

It is evident that the ideal to be aimed at is the preservation of both vessels, especially when dealing with the large trunks at the root of the neck and of the limbs; but when for any technical reason it is difficult or impossible to close the orifice of communication without sacrificing the vein, this should be done unhesitatingly if by this sacrifice the arterial lumen can be preserved, or the closure of the fistula better secured. The examples already given and the reports that follow will show

how, in some cases, the vein can be preserved in its integrity after the transvenous suture, and how, in others, it has been found necessary to ligate the vein above and below the anastomosis, or obliterate it by plication or utilize the attached segment to protect the line of suture with a reinforcing patch or flap cut out of the venous wall.

VI. The following case illustrates the application of the transvenous method of endo-aneurysmorrhaphy to a *varix* aneurysmaticus of the jugulocarotid vessels, in which the vein was obliterated by plication after the closure of the anastomosis, leaving the external and internal carotid circuit at the bifurcation open. This case shows all the evils that may follow a long-standing arteriovenous fistula as a result of the short-circuiting of the carotid stream through the fistula with secondary overstrain and dilatation of the right heart. It was a most trying and forbidding case which I would never have dared to approach by any other procedure.

Arteriovenous Fistula (Gunshot of Fifteen Years' Standing) of the Jugulocarotid Tracts, at the Bifurcation. Obliteration of the Orifice of Communication by Direct Suture Applied by the Transvenous (Transjugular) Route, Leaving an Open Collateral Channel to the Brain via the External and Internal Carotids and the Bifurcation (Fig. 8). The patient, John G., an intelligent negro barber, aged forty years, consulted me first on April 12, 1912. He had been shot in the neck fifteen years before he applied to me for relief of symptoms caused by an aneurysmal varix which, in the course of these years, had led to an enormous dilatation of the jugular and all the tributary veins. The man had been shot in an altercation, with a revolver, at close range, and the bullet (38 caliber) had perforated the internal jugular and the common carotid on a level with the bifurcation. The bullet, as was discovered fifteen years after, had lodged in the back of the neck and could be seen in the radiograph behind the articular process of the third cervical vertebra. The hospital record shows that one hour after the injury he developed unmistakable signs of an arteriovenous communication, which persisted and gradually grew

FIG. 12.—Interior of the sac exposed by opening the anterior venous wall. The method of obtaining hemostatic control is shown. The single orifice of communication with thickened edges is closed by continued suture.

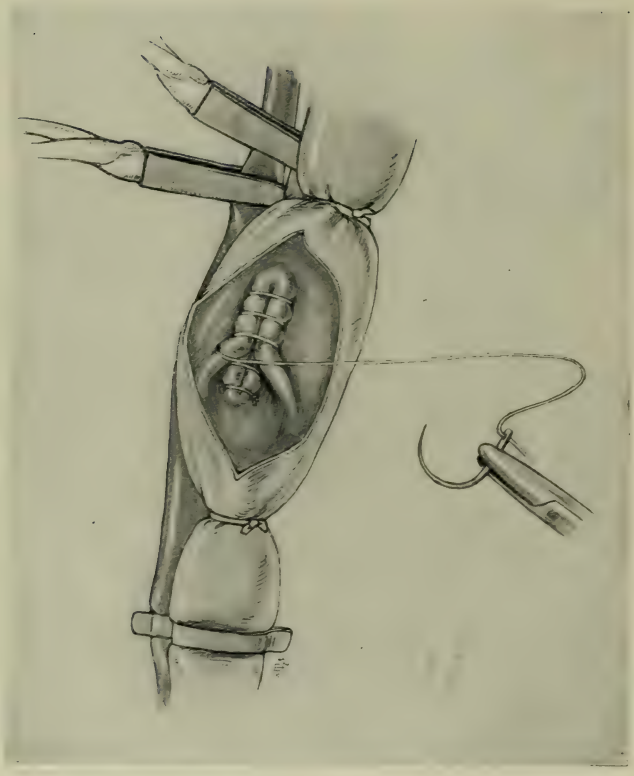

FIG. 13.—Obliteration of the sac by infolding and suturing the venous walls in superimposed layer after closure of the orifice.

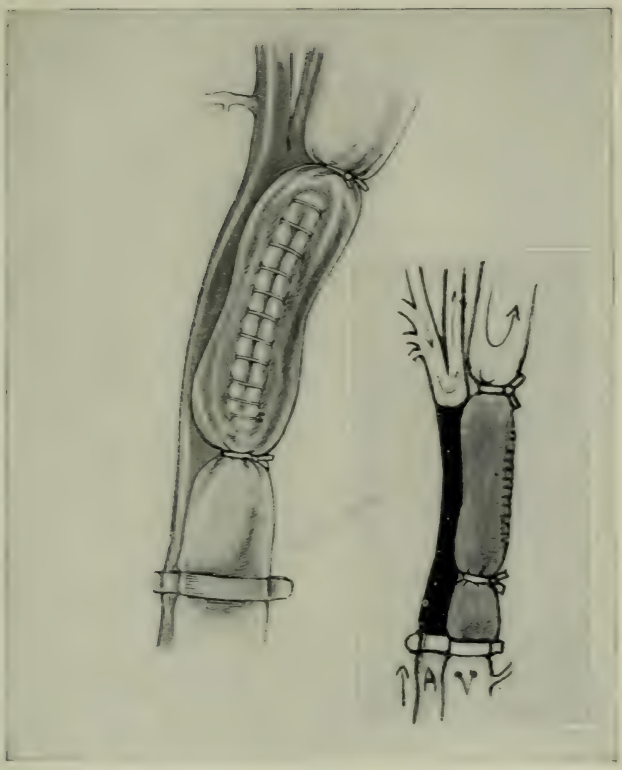

FIG. 14.—Case of John G.—jugulo-carotid aneurysm. *A* shows the fistula closed and the incision into the vein sutured. An additional row of sutures followed this to completely obliterate the vein by infolding or plication. *B* shows the final result with the lesser collateral circulation maintained through the external and internal carotid and the bifurcation.

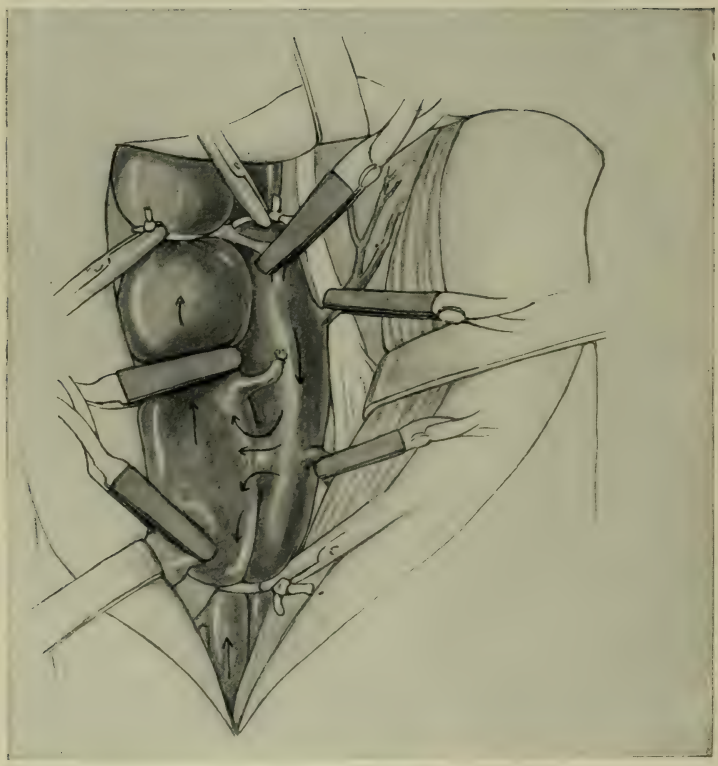

Fig. 19.—Deep dissection after division of Poupart's ligament and methods of prophylactic hemostases before attempting the detachment and separate suture of the vessels.

worse as time went on. Simultaneously with the bivascular injury the spinal cord had been wounded. From this injury he gradually recovered in the course of five years. Also, as an immediate sequel of this injury, he developed a traumatic meningitis with hyperpyrexia (107.6°), which kept him in a state of unconsciousness and delirium for fifteen days. He recovered slowly, but was finally discharged from the hospital, hemiplegic, with the aneurysmal varix in full activity. Apart from the annoying thrill and great noise which he heard roaring in his head, he was fairly comfortable and was able, at the end of five years, to return to his trade as a barber. It was not until about one year before his consultation with me that the aneurysm or, at least, the swelling in his neck grew rapidly, and he began to suffer with dyspnea and with "choking spells" whenever he made unusual muscular efforts. He then had to give up his work and go to bed. His history also showed that he had been a steady drinker and a syphilitic. He had a large dilated heart and aorta with an aortic obstructive murmur, an irregular pulse, and relatively low blood-pressure. He was a stout man, weighing over 212 pounds, and his neck was disproportionately large from the great turgescence and enormous dilatation and tortuosity of the superficial veins, which pulsated, purred and thrilled like living things. He had also developed a left-sided exophthalmos caused by the dilatation of the retrobulbar veins, which gave him a very striking appearance (Fig. 8).

Whenever he exerted himself he was seized with a dyspnea and a great anxiety, which he attributed to the aneurysm, as the veins swelled and formed a collar which he said "strangled him."

At first, I would not consider an operation because I believed the cardiovascular lesions were so advanced that they would soon prove fatal. However, after observing him for one month, it occurred to me that the dyspneic spells were, in part, due to the great strain imposed upon the right heart by the constant inflow of the enormous stream of arterial blood which was being short-circuited from the arterial into the venous

system, through the fistula, at the abnormal jugulocarotid junction. For nearly fifteen years his heart had been able to stand the strain by compensatory hypertrophy, but now, in consequence of myocardial degenerative changes, it yielded to the strain at the slightest provocation, and he was in constant danger of an acute dilatation. It seemed to me that if the fistula could be closed the great strain on the heart would be relieved and his general condition improved. Chiefly for this reason I yielded to his urgent solicitation, but with grave misgivings as to the outcome which he fully realized.

Operation. I decided that I would operate in two stages. The first was to be limited to the clearing out of a great mass of superficial veins which were in the way and prevented a free access to the common carotid; then a removable aluminum band, of the type that we had been using for years for this purpose (Matas-Allen band), was to be placed on the artery with a view of testing the efficiency of the collateral circulation in the brain, through the circle of Willis. The first step was to end at this stage of the procedure; the wound was to be closed and the effect of the carotid occlusion on the brain was to be observed for several days. If no complications followed, the second stage was to be undertaken in a few days with a view of closing the arteriovenous fistula and curing the aneurysm. This program was carried out to the letter, with some additions, on May 4, 1912. In view of the great dangers of general anesthesia, the operation, in two stages, was performed under local and regional anesthesia with novocain-adrenalin solution, preceded by a hypodermic of morphia gr. ¼ and scopolamin gr. 1/150. The difficulties of the operation were just as great as we had anticipated, and in completing its first stage, two hours and a half were consumed in one of the most difficult, tedious and trying dissections that I can remember in all my surgical experience. We were greatly assisted, however, by the patient's stoic and even cheerful attitude. He never complained and helped us at all times by placing his head and neck in the most favorable position for our work. In this way we were able to clear the field of the immense pulsating and

squirming plexus of veins which covered the entire field from the submaxillary region to the sternum and clavicle with very little loss of blood and with all the deliberation and neatness of a cadaveric dissection (Fig. 9). When this had been done the sternomastoid was divided at its sternal and clavicular attachments and reflected outwards, thereby exposing an immensely dilated jugular which completely overlapped and covered the carotid (Fig. 10). After dividing the omohyoid and sternohyoid, the site of the anastomosis was easily recognized as a cicatricial plug which could be felt over the mass that bound the carotid and jugular with the sheath of the vessels and held them together in an inextricable, fused, pulsating mass. Pressure at this point, which was the vortex of the great circulatory storm that raged in these parts, put an immediate stop to all pulsation and brought about the collapse of the veins. We availed ourselves of this subsidence in the venous swelling to clear out the common carotid and apply the aluminum band on this trunk at about one and a half inches above the left sternoclavicular joint. The seat of the anastomosis we had now located, with accurate precision, on a level with the bifurcation. On releasing the pressure at this point, the jugular filled again and pulsated, but very much less vigorously than before the banding of the carotid. In view of this greatly diminished activity of the arteriovenous circuit, an additional band was placed on the jugular about one inch from its junction with the subclavian. Seeing now that the vein became distended and pulsated to the level of the obstruction, a chromic catgut ligature was placed on the vein an inch and a half higher up, and that much nearer to the anastomosis. This reduced the size of the ampullar swelling very considerably, and, as the first stage of the operation had been completed, we decided to close the wound provisionally.

Notwithstanding the long and tedious ordeal, the patient was sent back to his bed in excellent condition, with a pulse of 100, respiration 22, and in a cheerful frame of mind.

In the absence of all complications, cerebral or otherwise, the second stage of the operation was undertaken on the third day

after the operation, when the dressing was removed for the first time.

Second Stage. On lifting the cutaneous flap the wound was found clean. The occlusion of the carotid and internal jugular had exercised a wonderful influence in diminishing the venous turgescence and erethism of the whole field of the operation. One significant fact remained: the arteriovenous fistula at the carotid bifurcation was still active. The pulsation and thrill could be still felt at this point, though greatly subdued. It was evident that the arteriovenous fistula was now fed by the arterial current which was coming from the collaterals of the opposite side through the external carotid to the internal carotid and again into the jugular through the fistula (Figs. 11 and 12). Evidently, the flow into the jugulocarotid fistula could not be stopped, or the aneurysm cured, until the circulation going on through the external and internal carotids had been arrested. To accomplish this, these vessels were temporarily and individually compressed above their origin at the bifurcation with two small, padded Hoepfner clamps (Fig. 12). The internal jugular was now ligated on the cephalic side of the arteriovenous junction. This made it safe to proceed with the next step of the operation, which was to open the jugular vein freely over the site of the fistula and thus expose the interior of its ampullar swelling and close the orifice of communication leading to the artery through the venous side. A longitudinal incision of about one and a half inches was made into the venous pouch through the collapsed walls of the vein. The orifice of the fistula was now brought to view. It was elongated, oval shaped, and a little over a half inch in its longest diameter. Beyond it the lumen of the enlarged carotid could be recognized, and by passing a vaselined probe, the orifices of the internal and external carotids could be felt arising a short distance beyond the edge of the opening. The opening itself seemed to occupy the center of a partition or diaphragm, formed by the adherent walls of the artery and vein. There was no interposed space or sac between the two. The edges of the fistulous orifice were smooth and rounded,

and just thick enough to give a good firm grip to the small curved needle and paraffined silk that was used to close it. Six continued sutures passed through the edges of the opening were quite sufficient to close it hermetically (Fig. 12). To secure further protection, a second line of continued chromic gut suture was made to cover the first line, by plicating the relaxed venous walls over it (Fig. 13). This reduced the cavity of the venous sac to a notable extent, but still left a very considerable excess of sac, which was partially trimmed off with scissors sufficiently to permit the complete obliteration of the cavity by infolding the edges of the vein and holding them in apposition ("capitonnage") by a continued gut suture. In this way what was once a large venous ampulla was transformed into a thick padded cord which completely obliterated the jugular from the proximal to the distal ligatures which had been previously placed on the vein, above and below the anastomosis (Fig. 14). The clamps were now removed from the external and internal carotids. It was soon determined that a reduced circulation had been established through these vessels, by way of the bifurcation, and that while the arteriovenous communication had been completely closed, a new channel for the arterial supply had remained. In this way, also, the main object of the operation had been obtained with a sacrifice of the vein, but with a greater conservative result on the arterial side than we had anticipated. This second sitting consumed, in all, about one and a half hours and was also carried out without any general anesthetic, except a preliminary hypodermic of morphia and scopolamin. At the close, the wound was carefully dressed and drained at the lower angle.

All signs of an arteriovenous anastomosis had disappeared completely. From May 6 to 8 he continued to do well, only complaining of pain in swallowing. On dressing the wound on the 8th, evidences of suppuration and staphylococcal infection were discovered in the tract of the drain and several sutures were removed, allowing some seropurulent fluid to escape. The infection had begun under the flap and a cellulitis was suspected between the lower carotid sheath and the

pharynx. The pulse rose to 100 and showed more irregularity and intermittency. The mental attitude was perfectly clear and even cheerful; no evidences of cerebral disturbances. Dysphagia and occasional spells of dyspnea were the chief troubles. The wound was dressed twice daily, and the infection seemed to be controlled. On the night of the 11th he became restless and anxious, and complained that he could not breathe comfortably and had to be propped up on pillows. On the morning of the 12th he washed his mouth and attended to his toilet as usual, but persisted in sitting up. At 8.30 A. M. he complained of sternocardiac pains and distress in the precordia and began to struggle for breath. The pulse now became very irregular and feeble and he expired suddenly before the interne of the service could reach him.

Death, therefore, occurred nine days after the first operation when the carotid and jugular were occluded, and on the sixth day after the second sitting, when the arteriovenous fistula was obliterated.

At autopsy nothing was found in the wound that could account for the fatal termination. The fistula had been completely sealed and all the sutures had held. The internal and external carotids were pervious and free from clot. The brain and thoracic organs were preserved for a separate and detailed examination in the laboratory. Marked evidences of chronic endarteritis and miliary aneurysms were discovered in the cerebral vessels, but the cause of the fatal termination was found in the heart. The aorta was dilated and showed atheromatous plaques. The left coronary was obstructed by thrombus and the right ventricle was distended with clot which extended into the pulmonary artery. The heart itself was of large size, dilated, showing evidence of myocardial degeneration.

I have dwelt with some detail upon the report of this patient's case because it presents many unusual, if not unique, features:

It is the first case that I have been able to discover in the literature in which the special technic of transvenous endoaneurysmorrhaphy has been applied to suppress an arterio-

venous fistula of the jugulocarotid vessels with technical success. The only other instances that I can find, in which the *transvenous* method of endo-aneurysmal suture has been applied, are reported six years later, and are: (1) The operation performed on a young soldier by René Le Fort, of Lille, on July 20, 1917 (*Bull. Acad. de Méd.*, Paris, No. 31, August 7, 1917), in which the *internal* carotid and jugular veins were involved. The fistulous communication was closed by suture, applied through an incision made in the pouch formed by the dilated internal jugular. The artery remained pervious, and the vein was obliterated by plication and mattress sutures "capitonnage"), as in my case. The wound had been inflicted four months previously, and the technic was remarkable for its simplicity and rapid recovery of the patient.

The operation reported by C. P. Lecène, of Paris (*Bull. et mém. soc. de Chir. de Par.*, January 15, 1918, xliv, No. 1, 27-30), was performed on November 15, 1917. The patient, a soldier, aged twenty-five years, was wounded in the neck by a fragment of shell which perforated the common carotid and jugular, causing an arteriovenous anastomosis. The operation was performed about one month after the injury. In this case and in Le Fort's, the jugular vein was enormously dilated on a level with the arterial communication. The operator was able to close the slit-like opening of the fistula, which was clearly visible inside of the vein, by an intravenous suture with fine silk, and, in this way, he did a perfect restorative endo-aneurysmorrhaphy, which allowed the common carotid to remain pervious. The vein itself was closed by intravenous sutures applied above and below the seat of the anastomosis. The result was a brilliant success, by which the carotid circulation was restored, though the vein was obliterated at the seat of the anastomosis.

This case, as the preceding of Le Fort, is noteworthy in many ways, and especially as illustrating the relative facility with which the cure of an aneurysmal varix was effected in a particularly dangerous and difficult region. It is also a valuable tribute to the efficiency of the method, coming, as it does,

from an operator who had previously entertained and expressed a decided prejudice against the endo-aneurysmal methods of suture, but who, after this experience, loyally and honestly admitted that he had erred in his preconceived objections.

"Mais l'expérience qui seule juge en dernier ressort, m'a montré que mes prevéntions contre cette intervention [l'opération de Matas] étaient tout a fait injustifiées."

In my patient the continuity of the collateral arterial current to the brain through the external and internal carotids by way of the bifurcation remained undisturbed, and is also one of the unique features of this case. The proof that this collateral circuit remained active was demonstrated after the common carotid and internal jugular had been occluded.

The chief indication for the operation was also unusual, and perhaps unique, in the fact that it was undertaken chiefly with the hope that the closure of the arteriovenous fistula would relieve the strain on the right heart due to the short-circuiting of the carotid stream into the venous system, causing a progressive dilatation with dangerous and distressing symptoms.

VII. The opportunity to test the full value and end-results of the transvenous route in attacking aneurysmal varices, which was denied us in the preceding case, soon presented itself in a succession of aneurysmal varices of the lower extremities, which came under treatment in our clinics in the interval between 1912 and 1919. The following two cases, abstracted from our records, suffice to show some of the peculiarities of the technic which has varied according to the conditions found in each case, but has always been guided by the same principle.

Traumatic Arteriovenous Aneurysm (Aneurysmal Varix) Involving the Femoral Vessels at the Groin, of Three Years' Standing, in which the Arteriovenous Communication was Successfully Closed by Transvenous Endo-aneurysmorrhaphy, with Preservation of the Lumina of Both Vessels. The patient, J. H. H., aged nineteen years, of Westminster, S. C., shot himself accidentally with a parlor rifle, 22-caliber bullet. The bullet entered the abdominal wall about one and a half inches

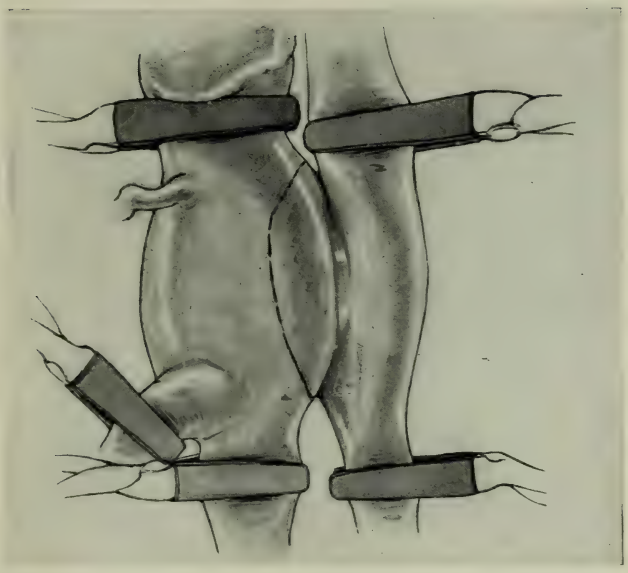

FIG. 20.—Detail of anastomosis to show line of incision on the vein in order to expose the interior of the sac.

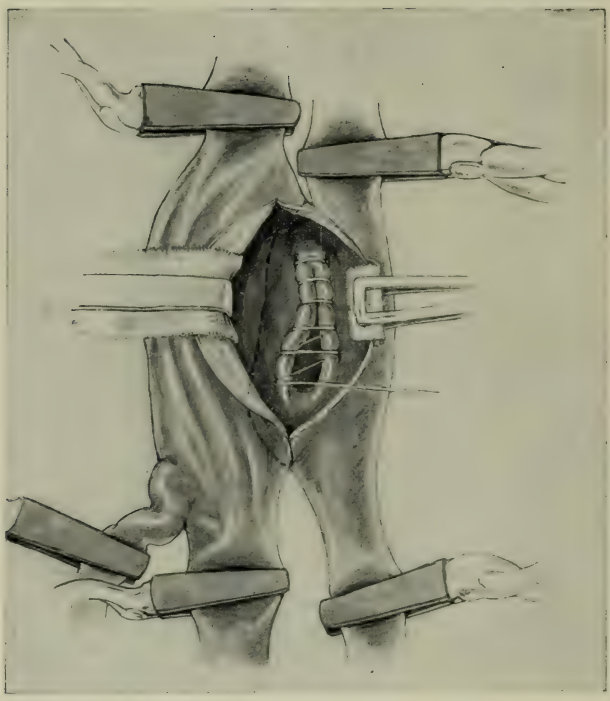

FIG. 21.—Interior of the sac, showing closure of the orifice of communication by continued silk suture.

Fig. 22.—The anastomosis closed; artery and vein detached, isolated and separately closed by lateral arterio- and phleborrhaphy. The arterial orifice has been closed separately by intrasaccular suture on the venous side and the first line of intrasaccular sutures is reinforced at the expense of the vein.

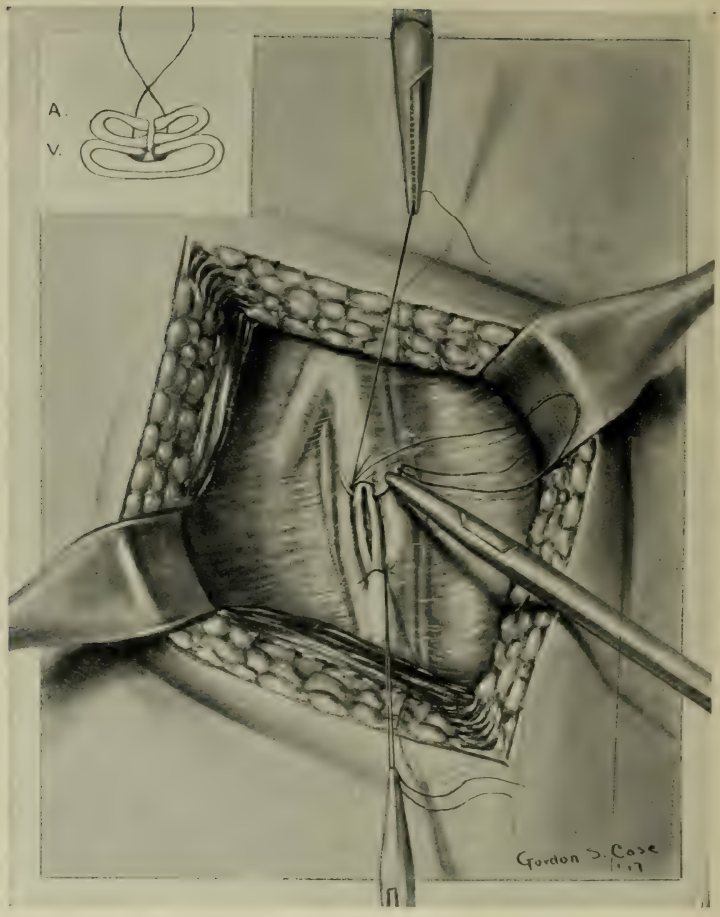

Fig. 23.—Case of Julius B.—Arteriovenous aneurysm of the femoral vessels at the apex of Scarpa's triangle. Shows interior of large space occupied by hematoma, covered over with a veil of semitranslucent exudate in process of organization. First stage of the suture. In the upper diagram (*a*) the needle is shown penetrating through both walls of the artery and through the arteriovenous septum, so as to close the narrow fistula which connected both vessels. By lifting the walls of the collapsed and thin vessels with two traction sutures, one at each end, the curved needle was able to penetrate the septum and obliterate the orifice in the vein as shown in the sketch, (*b*) without obliterating its lumen.

below Poupart's ligament and ranged downward, striking the femoral vessels at the groin, and losing itself in the depths of the left thigh. A tumor formed just below the middle of Poupart's ligament where a characteristic thrill and purring noise developed on the third day following the injury. He came under my observation on January 11, 1912, *three years after* the accident occurred. The affected limb was larger than the right, and he had large varicosities all along the saphenous tract from the thigh to the leg, with typical pigmentation of the skin and a rebellious ulcer below the knee which had resisted all previous treatment. The site of the abnormal vascular communication was easily localized at a point just below Poupart's ligament, a little to the inner side of the midline. At this point, the pulsation, thrill and characteristic murmurs were heard with greatest intensity. From this point the murmurs and thrill were transmitted upward as far as the umbilicus and below as far as the knee. The details of the operation which followed are well shown in the accompanying diagrams and drawings (Figs. 15-22). Iliac vessels were exposed by an extensive subperitoneal dissection, great difficulty being experienced in controlling the external iliac vein and its tributaries which had attained enormous proportions. The iliac vessels were provisionally controlled above and below the anastomosis (after Poupart's ligament had been divided) by elastic ligatures and padded clamps. The common femoral vein formed a large, well-defined sac of egg-like shape at the site of the fistula and at its junction with the saphenous. After controlling all the vessels, the aneurysmal phenomena were all stilled and the vessels collapsed. The sac, which was fully three and a half inches in length and two inches in breadth, had developed between the artery and the vein, but at the expense of the vein. The constriction or neck which united the sac with the artery was fully one and one-half inches in length. The sac was opened longitudinally on the venous side, exposing the full length of the large orifice in the artery. This was closed by a row of continued, vaselined silk sutures introduced from the venous side, thus bringing the endothelial sur-

faces of the orifices in perfect apposition. After this, a cuff flap was cut off at the expense of the venous wall, thus detaching the artery completely from the vein. This flap was sutured over the cuff in the manner shown in the diagram, leaving the artery thoroughly protected against leakage. The suture of the vein was easily accomplished, owing to the excess and laxity of the venous sac. After this all the controlling elastic ligatures and clamps were removed, allowing the blood stream to return at once through its normal channel. All the sutures in the artery and vein held perfectly, insuring the complete success of the operation. The operation was long and tedious, as was to be expected in such a chronic case, lasting nearly four hours. This was due chiefly to the innumerable and enormously dilated veins which had to be secured and ligated in the superficial planes before the main vessels could be reached (Figs. 15 and 18).

The most notable post-operative feature of the case was the extraordinary tachycardia that developed suddenly after the restoration of the circulation through its normal channels. This tachycardia, during which the pulse ranged from 170 to 190, continued until after the patient had recovered from the anesthesia and lasted for three hours after the patient was returned to his bed. At the end of this time the pulse suddenly became irregular and dropped in three minutes to 110, where it continued until it became normal the next day. Apart from this remarkable incident the patient made an excellent recovery and was discharged completely healed and well on February 19, 1912. Three years after his return home his physician wrote me that the boy had been in perfect health and that he had grown to be a big and robust man.

In this case, as in all others of long standing, the baneful effects of the short-circuiting of the large arterial channels, especially at the root of the limbs into the venous circulation, were particularly noticeable, and proved that the sudden readjustment of the circulation by the closure of the abnormal arteriovenous communication is not without its dangers.

Arteriovenous Aneurysm of the Femoral Vessels at the Apex of Scarpa's Triangle in a Boy of Fifteen Years in which the Orifice of Communication was Closed by a Transarterial Suture. A Pulsating Hematoma Caused by the Simultaneous Transfixion of the Artery and Puncture of the Vein by Stab (Fig. 23). This boy, Julius B., was brought from Sterling City, Texas, September 3, 1916, twenty-four days after he had accidentally wounded himself in the right thigh with a long-bladed pocket knife while splitting a piece of wood. The knife had entered the upper thigh about five inches below Poupart's ligament. The boy was still suffering from the effects of severe hemorrhage. A linear scar indicated the point of entrance of the knife and about this was a spherical swelling which pulsated, purred and thrilled in the characteristic fashion of arteriovenous injuries. The pedal pulses were feeble, but on testing the collateral circulation by our methods, it was shown that an ample supply of blood was going to the periphery by the collaterals outside of the main channels, and that an obliterative operation could be performed with safety if it became necessary. Prophylactic hemostasis was secured by the Esmarch bandage and the constrictor was held high up near the groin with a Wyeth pin. With the scar as the center of the incision, a sac was opened above the sartorius which led to another cavity under this muscle. This cavity was already partially lined with a thin veil of organized exudates which hid the vessels completely. A slit-like opening about ½ inch in length was now discovered in the floor of this space running parallel with the long axis of the femoral vessels, which were lying superimposed one on the other under the thin lining of the sac. An exploration of this opening demonstrated that it led to the artery and not the vein, as we had at first supposed, and that this vessel had been transfixed and the vein punctured.

The flatness and breadth, as well as thinness of the collapsed artery, with the narrow slit-like wound lying in its center permitted us to suture and obliterate the arteriovenous opening simultaneously with the external wound in the artery. The technic adopted is shown in the accompanying Fig. 23. On

removal of the constrictor, the blood rushed into the artery which pulsated, blood circulating on each side of the suture line and beyond, into the artery, distal to the central line of suture. All the aneurysmal signs ceased completely and the circulation of the foot was perfect, the pedal pulses remaining as they had been before the operation. Healing took place *per primam,* and, after a short period of rest, hydrotherapy and massage, the patient was discharged healed and well on the twentieth day after the operation. I have since heard from the patient, and up to the present time he is in perfect health.

This operation is unusual and perhaps unique in the fact that an arteriovenous fistula was obliterated through an abnormally thin arterial wall, thus constituting a trans-arteriopheleborrhaphy rather than the usual procedure of endophlebo-arteriorrhaphy.

IX. Our records show that four additional cases of arteriovenous aneurysms involving the femoral vessels have been operated upon in our clinics since going through the preceding experiences which exhibit individual features and peculiarities of special interest to the surgical technician deserving detailed consideration in a separate publication. They all have the one feature in common, in that they were long standing aneurysmal varices presenting all the difficulties and complications peculiar to the chronic stages of this class of lesions; each one offering a serious problem to tax the judgment, skill and resourcefulness of the most experienced operator. All of these, however, were happily solved by the intrasaccular methods herein described with such modifications as were suggested by the conditions met in the course of the operation. Finally, the experience gathered from these cases has convinced me that the possibilities of cure by this method are as great in arteriovenous aneurysms as in purely arterial.

X. Since writing these observations and in reviewing the history of the war, I am gratified to note that the aneurysmal method of treating arteriovenous aneurysms by the intrasaccular suture of the communication orifice by the transvenous route, as described in this paper ("Matas-Bickham Method"),

has been received with favor by Sir George Makins in his excellent monograph on *The Gunshot Wounds of the Blood-vessels* (London and New York, 1919). In referring to the treatment of aneurysmal varix, he says: "The indications for operation for this condition are less precise than in the case of the varicose aneurysms. There is no doubt that many aneurysmal varices, especially in the upper extremity, do not call for operation, and may be left untouched without risk to the patient. Either pain, increasing local distention of the vein, or signs of increasing and troublesome obstruction to the peripheral venous circulation, may render operation advisable or necessary.

"The vessels may then be ligated above and below the level of communication and the varix excised. A far *preferable method is to close the communicating opening by suture,* as has already been described under the heading of arteriovenous aneurysm. If a direct opening exists between the artery and vein, the latter should be opened freely; the communication is then exposed and may often be stitched up without any further preparation. If the sac be situated between the vessels, it should be opened first, and the communication can be stitched from this point."

Continuing on page 86, he again states: "In pure aneurysmal varices the almost invariable route to the anastomotic opening should be through the vein; if this procedure be adopted the closure of the opening into the artery is easy and that of the incision into the vein simple in the extreme," etc.

Here, then, we have a full acceptance of the intrasaccular suture applied by the transvenous route which Bickham first described in 1904, as an application of the method of endo-aneurysmorrhaphy to arteriovenous aneurysms which I had described in 1903. While it is gratifying that so experienced and eminent a surgeon as Sir George Makins should have so clearly signified his approval of this method, it is surprising that one so well informed in the literature of vascular surgery nowhere suggests or even hints in his book that this method had been devised, described and applied in America ten years

before the declaration of the war. In this he differs from his French colleagues, Lecène, Forgue and others who fully recognize the antebellum as well as the American origin of the method.

Bibliography

Swan, J.: Tr. Med. Soc., London, 1917, vol. xl, p. 269.

Eccles, W. McA.: Jour. Roy. Army Med. Corps, London, 1916, xxvi, pp. 405–415.

Soubbotich, V.: Bull. et Mém. Soc. de Chir. de Paris, 1916, xlii, 698.

Bier, A.: Bruns's Beitrag. z. klin. Chir. Kriegschir., Hefte 1915, Bd. 96, p. 506.

Küttner, H.: Berlin. klin. Wchnschr., 1916, Nos. 5 and 6, pp. 101 and 132. Bruns's Beitrag. klin. Chir. Kriegschir., Hefte 1917, Bd. 108, p. 1.

Hotz, G.: Beitrag. z. klin. Chir., 1915, Bd. 97, p. 177.

Donati: La Chirurg. deg. org. di Movimento, 1917, vol. i, Fasc. 2.

DISCUSSION

Dr. Charles H. Mayo, Rochester, Minnesota.—I think American surgery is to be congratulated on the many additions to the various subjects of surgery that have been contributed by Dr. Matas as a student, a research worker, and a most active surgeon. Of the contributions he has made nothing is of more importance than his work on vascular surgery. From one or two standpoints I want to corroborate what he said about the use of catgut. Catgut is not a good arterial ligature in a case of aneurysm. Years ago I had a patient, about forty-six years of age, who had an aneurysmal varix of the cavernous sinus. When I used a catgut ligature on the varix the patient had a convulsion on the table. I loosened up the ligature and the convulsion ceased; the procedure was repeated three or four times and then the convulsion ceased, so that I brought the ligature down tight. At the end of nine days pulsation was again definite. If I had ligated with silk there would have been no recurrence of the trouble. I have known of one case since in which an arterio-

venous varix was ligated with catgut at the point of communication, the only case in our clinic that was a failure. In arteriovenous varix an opening of large size must be treated by the method of Dr. Matas, but in many cases a small opening is found and it is wise to ligate the communicating branch. The location of the opening may be determined by palpation and a silk ligature quickly tied. We have treated in this manner a number of cases of small aneurysms due to gunshot, small shot, buckshot, a stab with a knife or a thrust of a pitchfork. I recall the interesting case of a woman, fifty-six years of age, who showed the need of bands of which Dr. Matas speaks. Some years ago she came to me with one eye gone and with an arteriovenous aneurysm of the cavernous sinus. One carotid had been ligated, and because of some operation which had been performed on the eye it was necessary to remove it. The aneurysm had crossed into the opposite cavernous sinus. Under local anesthesia I applied the band of Dr. Matas, and as I compressed it the patient became blind in the remaining eye. I loosened up the clamp to strike a happy medium of pressure which would relieve the trouble and not greatly reduce vision. I left the band on. I know that for two years the patient was quite comfortable in that condition.

Dr. J. Shelton Horsley, Richmond, Virginia.—The work of Dr. Matas on the surgery of aneurysms is one of the great contributions, if not the greatest contribution, that has ever been made in the whole history of the surgery of aneurysms. The beauty about it is he works along the line of restoring the circulation as nearly as possible to its normal physiologic condition, to put it back where Nature had it before the injury. The operation that he has devised for arteriovenous aneurysm is apparently an extension of his restorative type of aneurysmorrhaphy. There is one point we sometimes forget about arteriovenous aneurysm—that the vein in these cases does not maintain its function. If there is an aneurysm of the artery itself it is important to spare the vein because injury of the vein in an ordinary aneurysm is a very serious thing—it may result in gangrene—but in arteriovenous aneurysm the vein is out of commission because the pressure of the arterial blood in the vein prevents the venous blood from circulating through the vein. As a matter

of fact the arterial blood goes down to the valve below the opening and plugs it, and the venous blood has to find collateral circulation. It makes no difference, so far as restoration of the venous circulation is concerned, whether you restore the vein or close it. If the vein is large it would probably be better to cut it out than to leave it. The point of ligation with catgut, of which Dr. Mayo spoke, is important. It seems to me we can use catgut on a large artery safely as a double ligature tied, not at the same place but at a distance of half an inch or one-quarter of an inch. In that way the ligature nearest the cardiac side acts as a buffer and takes the strain of the heart impulse from the second ligature, and the tissues here can heal much more satisfactorily.

Dr. A. C. Scott, Temple, Texas.—To Dr. Matas an apology is due from me for failure to keep my promise to report some of the cases I have had, and I think perhaps it would be well to mention them here, because it would add to his list, and instead of his having 317 he should have 320 cases. I have had 3 cases of aneurysm in which Dr. Matas's operation was performed. Two of them were of traumatic origin. In 1 case a little girl about twelve years of age, the aneurysm was of the brachial artery and about the size of a turkey egg. In the other case, a woman, aged thirty years, the aneurysm was of the radial artery and about the size of a small hen's egg. The third case was of specific origin and involved the femoral artery in a very active traveling man, who had for about two years observed the gradual development of a painful tumor upon the inner side of the left thigh without any suspicion whatever of its significance and danger, and who was going about carrying a heavy suitcase while attending to his daily work. For about ten days prior to his appearance at our institution he observed a rapid increase in the size of the tumor, accompanied by increased pain and soreness. At operation it was found that he had a slight leak into the muscular tissues about the center of the thigh from the aneurysmal tumor, which involved about ten inches of the femoral artery, extended through Hunter's canal and also involved about one inch of the popliteal. The operation as originally ascribed to Dr. Matas was done, and I feel quite sure that any other form of operation would have so interfered with

collateral circulation as to have gotten an entirely different result. Prompt recovery was obtained in all 3 cases.

Dr. Rudolph Matas (closing the discussion).—Dr. Mayo's experience is very interesting and brings out one point which should be remembered in the application of the band. This is an adjustable flat aluminum band which can be removed in the event of the development of an ischemic circulation. I used it first as a modification of Dr. Halsted's rolled aluminum band in cases of lesions (aneurysms or other tumors) of the carotid tract instead of a ligature. It is easier to apply than a ligature. I have received letters from many men who imagined that the band had to be removed, and judging by this it would seem the application of the band is not fully understood. It is better than a ligature because it is not positively chemotactic. It does not attract any bacteria to it. It is perfectly sterilizable. If cerebral symptoms follow the occlusion of the carotid you can remove the band or relax the tension sufficiently to ensure an inflow of blood. You can do this with safety for two days or fifty-six hours, as Dr. Allen's and my joint experiments showed years ago. You can preserve the intima, so that at the end of fifty-six hours, if you do not crush the artery in occluding it with the band, the vessel lumen will still be preserved. When collateral circulation is insufficient in the brain, cerebral symptoms come on promptly; they manifest themselves usually within sixteen hours after the occlusion, and, if you take off the band, the circulation is restored in the vessel. If no symptoms follow the occlusion do not worry about the band. It will remain embedded in the tissue and cause no more disturbance than an aseptic ligature. The points made by Dr. Horsley are excellent, and I appreciate the commendation of so excellent a master of the technic of vascular surgery. Another word about the advantage of leaving the vein after we have done an obliterative suture in arteriovenous anastomosis. It is a good reinforcing pad over the orifice. A second double layer of sutures is an advantage; close the vein over again and it remains as a living cord and an additional protection. I am very much obliged to Dr. Scott for the recital of his cases and hope he will publish them in detail.

THE MODERN TEACHER AND PRACTITIONER OF OBSTETRICS AND WHAT IS EXPECTED OF HIM AS A SURGEON IN THIS DEPARTMENT

By E. Gustav Zinke, M.D.
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Up to fifty years ago it was, indeed, very rare for the teacher and practitioner of midwifery to resort, personally, to any of the capital obstetric operations. He contented himself with the application of the forceps, internal version of the child, embryotomy and the use of the cranioclast and craniotribe; and, in not a few instances, he called upon a surgeon to perform even the latter operations for him. It was not until the gynecologist and abdominal surgeon had come upon the scene that the obstetrician began to perform primary and secondary perineorrhaphy and trachelorrhaphy. Rectovaginal and vesicovaginal fistulæ were left entirely to the gynecologist or to the general surgeon, and most of the victims thus afflicted remained, for the rest of their lives, without relief, and became, virtually, prisoners confined in their own homes. Cesarean section, if it was performed at all, was nearly always done by a general surgeon, and, in later years, by the abdominal surgeon or the gynecologist. The obstetrician pursued the same course in cases of ectopic gestation. Within the last two generations, however, a marked change has taken place in the practice and teaching of midwifery.

To make clear what I am eager to impress upon the profession, permit me to divide the obstetricians of today into four classes: (*a*) those who teach and practise midwifery as a spe-

cialty; (*b*) those who teach obstetrics, but who, in addition, practise gynecology and abdominal surgery, and not infrequently treat other diseases; (*c*) those who practice obstetrics exclusively, but who hold no teaching position in a college or hospital; (*d*) those who accept care of the pregnant and attend cases of labor, but who practise, principally, so-called "general medicine."

Class (*a*).—The teacher and practitioner of obstetrics, the specialist in this department. His field comprises everything pertaining to the physiology, prophylaxis, and pathology of pregnancy, labor and confinement from a medical and surgical point of view. The teacher of obstetrics who cannot meet any emergency that may arise during pregnancy, labor or the puerperium is not well qualified to fill the position he occupies. He should be prepared not only to use the forceps, to make an internal version of the child or perform an embryotomy, but he should be able to do a Cesarean section, a hysterectomy or operate for extra-uterine pregnancy upon the spur of the moment, if need be, provided the condition and the environments of the patient admit of the successful execution of these operative procedures. He should be able also to repair, primarily, extensive injuries of the mother's soft parts, not excluding partial and complete rupture of the uterus.

This explanation means that the obstetric specialist must know, to a considerable extent, abdominal surgery and gynecology. It should not be his province to operate for gall-stones or to perform appendectomies, gastrectomies or other stunts upon the intestinal canal, or upon the other abdominal viscera, the kidneys, liver and spleen. Nor should he operate for hernia, pus tubes and the various diseases affecting the female pelvic organs. It is, however, the obstetrician's privilege, aye, even his prerogative, to operate for vesico- and rectovaginal fistulæ if he chooses to do so, especially if these conditions occur in cases which he attends in labor. These are, in brief, not only the justifiable but the imperative extent and limit of the specialist in midwifery of today who teaches and practises obstetrics exclusively.

Class (*b*).—The teacher of obstetrics who practises gynecology and abdominal surgery, or who specializes in diseases of children or who follows general practice, is, essentially, the modified product of two generations ago. The teaching and the practice of obstetrics exclusively have been and in some places still are so meagerly remunerative, that he who attempted to do so could not earn enough money to provide sufficiently for himself and family. Necessity compelled him to seek other professional work; and this, in nearly all instances, was done at the expense of his teaching ability and his skill as a practising obstetrician.

Class (*c*).—In this class belong the few men (and they are, indeed, too few) who now practise obstetrics to the exclusion of everything else, and who occupy no teaching position in midwifery. These men are of recent date. They fill a most important position in every community. Their surgery is limited to primary perineorrhaphies, the application of forceps and bimanual and internal version. They do not attempt, as a rule, to operate for ectopic gestation or to perform Cesarean section. These men study carefully every case that comes before them, and, when they recognize conditions indicative of probable or of unavoidable danger, they refer the particular case to the obstetric specialist described under Class (*a*). These men represent the highest, the best and purest type of the man-midwife of whom, it may be truly said, we have not a sufficient number.

Class (*d*) comprises the so-called general practitioner of medicine, the general surgeon, the gynecologist and specialists in other departments, men who openly profess to know little or nothing of the science and art of obstetrics, but who are, nevertheless, easily persuaded to accept cases of pregnancy and of labor when a good fee is in sight. Unfortunately for the obstetric specialist we have with us too many of this kind; they have sapped much of the life out of obstetricians of the past and thus have naturally retarded the growth of obstetrics into a well-defined specialty. Their activity has been for evil rather than good. Because of the little knowledge they possess of midwifery, they are frequently a menace to those who trust

themselves to their care. These are the men who practise medicine and surgery, not so much for the amount of good they may be able to do, but rather for the sake of the money they may make out of these branches of medicine. They are the men who look upon the medical profession as a business, not as a great morality; with them it is a trade, not a God-given mission for the benefit of mankind.

There is, in reality, room for only two classes of obstetricians: The teacher of midwifery and obstetric surgeon is one; and the practitioner of obstetrics, who is neither a teacher, gynecologist nor abdominal surgeon, is the other. Of the former we have a right to expect that he knows the science and practice of midwifery from A to Z, and that he is able and well prepared to cope with any condition or emergency that may arise during pregnancy, labor and confinement. He must be qualified to operate for ectopic gestation and rupture of the uterus, and to perform a Cesarean section as readily as he would manage a case of postpartum hemorrhage, tie a bleeding vessel in a torn cervix or perform a primary perineorrhaphy. He should be able to discuss intelligently, without previous preparation, any subject dealing with obstetrics. This knowledge, and nothing less, is what we have a right to demand of the man who is engaged in teaching obstetrics; it is he who is to act as a consultant to others and who is to sit in judgment as to what is the best and wisest thing to do in difficult and perplexing cases. Thus the knowledge and skill of the teacher of obstetrics must extend, to a certain degree, into the field of gynecology and abdominal surgery.

Of the obstetric practitioner—not the teacher of midwifery—we also have a right to assume that he knows thoroughly the anatomy, physiology, prophylaxis and pathology of pregnancy, labor and confinement. It is taken for granted that he is thoroughly familiar with obstetric diagnosis and prognosis, and that he knows "by heart" the mechanism of labor of every presentation and position; of him it is expected that he studies every case painstakingly so that he may know in advance, more or less exactly, the future possibilities of every case of preg-

nancy brought before him. He is not supposed to perform a Cesarean section, or to operate for rupture of the uterus or ectopic gestation, but he should know whether a Cesarean section will be necessary, how to avoid the dangers leading to rupture of the uterus, and how to differentiate between intra- and extra-uterine fetation. He should know when and how to use the forceps, how and when to perform a version, and how to repair a freshly-lacerated cervix and ruptured perineum. He should possess the ability to treat intelligently placenta previa in a non-surgical manner, and he should be thoroughly familiar with the toxemias of pregnancy and the medical treatment of puerperal convulsions. The nation, in fact the whole world, is sorely in need of the men just described. Though it takes a good man to be a real surgeon or a good practitioner of medicine, a still better man is required to make a competent, special practitioner of obstetrics, such as is defined above. He will be far above the ordinary English midwife, the German hebamme and the sage-femme or accoucheuse of France.

Different it is with the professor of obstetrics in a medical school. To maintain the dignity of the science and art of obstetrics, he must be, to a degree at least, a gynecologist and abdominal surgeon; for it is difficult to imagine a professor of obstetrics who would be obliged to call in a surgeon to perform a Cesarean section or to operate upon a case of rupture of the uterus in his stead. And yet we have with us just such men. Let us guard jealously the prerogatives as well as the dignity of the obstetric specialist—the teacher as well as the practitioner.

SARCOMA OF THE STOMACH, WITH REPORT OF A CASE AND AN ANALYSIS OF 107 CASES OPERATED UPON

By William D. Haggard, M.D.
Nashville, Tenn.

Primary gastric sarcoma is one of the rarest surgical diseases. There is but 1 example of sarcoma of the stomach in 840 specimens of sarcoma in the Berlin Pathological Institute. Sarcoma was present in only 4 of the 921 cases of gastric cancer operatively and pathologically studied by Smithies. Tilger cites 4 cases in 3500 sarcomas. It occurred 6 times in 13,387 necropsies (Hosch). In 27,250 abdominal sections at the Mayo Clinic in five years (Masson) there were 8 sarcomas of the stomach, and of 2067 malignancies of the stomach (1908-1920) 13 proved to be sarcomas, or 1 sarcoma to 159 carcinomas of the stomach.

In 1847 Bruch recorded the first case of gastric sarcoma. Forty years later Virchow operated on the first patient. In 1900 Fenwick studied 60 cases in the literature and concluded that 53 of them were authentic. Since that time many other cases have been published, the majority being necropsy specimens.

In 1912 Gossett added 16 cases to Zesas's collection and reported them together with his case, making 61. Of this number, 39 were exogastric and 22 were endogastric. Of the latter, 13 were resected, with 5 deaths. Of 3 living, 1 lived four years and 1 six years. Of the 29 gastrectomies of the exogastric type there were 10 deaths, totalling 42 resections, with 15 deaths (35.7 per cent). Eight survivals occurred from three months to seven and a half years. Three patients were living after endogastric operations, one, four, and six years respectively.

In 1914 Flebbe was able to collect 157 cases. Those cases based solely on necropsy findings are not included in this paper, as they are rather of pathologic interest and throw no light on the progress of surgical treatment. I have been able to find in the literature 93 cases of sarcoma of the stomach which came to operation, in addition to 13 unpublished cases at the Mayo Clinic and 1 of my own, making a total of 107 operative cases and a total of 244 authentic cases of primary sarcoma of the stomach. Probably a much larger number have been operated on, reports of which are not now available.

The personal case herewith appended was a leiomyosarcoma. There are 2 other similar cases in this series and also 2 cases that are classified as leiomyoma malignum, which for all practical purposes is sarcoma. In fact, Balloch, writing on benign tumors of the stomach, quotes Fenwick as follows: "We have not been able to find a single case in the whole of the literature where a large fibroid tumor of the gastric wall was above suspicion of malignancy."

Sarcoma of the stomach may occur at any age in life. The youngest case was that of Finlayson, a boy of three and one-half years, and it has been known to occur in a man of eighty-five (Gossett). Although sarcoma has been thought to be a disease of young life, it more frequently involves the stomach after the fortieth year of life. Of the 107 cases which I was able to collect from the literature the age was given in sixty-one. The youngest was a boy, aged three and one-half years, the oldest a woman, aged seventy-four years.

AGE INCIDENCE

Patients under 10 years	2
Patients between 10 and 20 years	4
" " 20 and 30 "	3
" " 30 and 40 "	12
" " 40 and 50 "	14
" " 50 and 60 "	12
" " 60 and 70 "	11
" " 70 and 80 "	3

One patient was spoken of as an old man. The sex was given in 66 patients, and of these there were 33 females and 33 males. One case gave a history of symptoms coming on shortly after a fall in which she struck the pit of her stomach. One case came on two months after receiving a kick in the abdomen by a mule (McWhorter).

The size of the tumor varies within wide limits from the size of a bird's egg to the case reported by Baldy in which the tumor filled the entire abdomen. From a histologic standpoint the tumor may be any one of several varieties: Round-cell, spindle-cell, mixed-cell lymphosarcoma, myosarcoma, fibrosarcoma, angiosarcoma and endothelioma (Clendenning). These tumors are liable to undergo degeneration. They may become cystic from hemorrhage, sometimes calcareous; hyaline and myxomatous changes may also occur. There is some tendency to ulcerate. On the other hand the tumor may show no signs of ulceration, but may appear as a smooth or nodular mass. The round-cell sarcoma is the type most liable to be mistaken for cancer from its gross appearance. It usually infiltrates and most often involves the pyloric end. It rarely produces pyloric stenosis, however, in contradistinction to carcinoma. This type, through infiltration and thickening of the walls of the pyloric portion, sometimes renders them stiff and deprives the lower half of motility and thereby causes obstructive symptoms. This type of sarcoma seems to be more malignant and to metastasize more rapidly. The spindle-cell sarcoma is liable to be circumscribed and often pedunculated. In its growth it may present itself externally beneath the serosa or internally beneath the mucosa. In the latter instance it may resemble a polyp. These tumors are the type that grow to a very large size. They have been mistaken for an ovarian cyst or a floating kidney, and very readily, since in many instances they may produce no gastric symptoms whatever. This type of tumor is slow to metastasize. They form the best type to deal with surgically and offer a far better prognosis than other types. Sarcoma may involve any portion of the stomach and in a few cases the

entire stomach was affected. The growth is relatively slow (in one case three and one-half years), but may be quite rapid.

"A sarcoma of the stomach may be, according to its cell origin, a leiomyosarcoma, a fibrosarcoma, a lymphosarcoma or an endothelioma. There is little doubt also that some or many of these so-called large, round-cell sarcomas are of muscular origin" (Ewing). Any one of these, like sarcoma elsewhere, may have either round cells or spindle cells, the former, as is well known, being the most malignant. A lymphosarcoma is most likely to metastasize, whereas an endothelioma is least likely. A leiomyoma is the slowest growth, but, as a rule, occurs at a later age than lymphosarcoma or fibrosarcoma. The grafting of sarcoma, whether round or spindle-cell, upon leiomyoma of the stomach is, according to Warner, doubtless identical with a similar process in the uterus. Probably neither is malignant in the beginning.

The microscopic diagnosis was given in 76 cases. There were:

12 spindle-cell sarcomas.
17 lymphosarcomas.
8 round-cell sarcomas.
8 fibrosarcomas.
4 sarcomas (only).
5 myosarcomas.
2 small round-cell sarcomas.
3 large round-cell sarcomas.
2 leiomyomas (malignant).
2 leiomyosarcomas.
3 myxosarcomas.
4 mixed-cell sarcomas.
1 cystic sarcoma.
1 angiosarcoma.
2 fusocellular sarcomas.
1 hemangio-endothelioblastoma.
1 myxofibroma.

Among these 61 cases the posterior wall was involved 16 times, the greater curvature 10 times, the pylorus gave origin

to the tumor in 7 cases, the tumor was diffuse in 8 cases, the lesser curvature was involved 7 times and the anterior wall 4 times. The fundus was the site of the growth in 2 cases. The entire stomach was involved in 2 cases. The stomach was described as being reduced to a band in 1 case. The greater portion of both sides of the stomach was affected in 1 case. The tumor was described as being near the pylorus in 1 case and in another the tumor was attached to the stomach omentum and the transverse colon. In 1 case the pylorus was spoken of as being normal, the tumor involving other portions of the organ.

Sarcoma is said to metastasize in 40 per cent. of the cases. In this regard it is not nearly so malignant as cancer. It is prone to metastasize in the skin. This feature has been considered of diagnostic significance. However, Leube found a case in which there was carcinoma of the stomach and sarcomatous nodules in the skin. Sarcoma springs from the muscularis and submucosa and not infrequently dissects its way between the mucous and muscular layers. Ulceration may occur through the mucosa. Perforation is liable to occur. This is especially true of the round-cell sarcoma, which is said to perforate in 10 per cent. of cases. Lymphosarcoma may be a primary or a secondary lesion, or it may be a manifestation of Hodgkin's disease and not primary sarcoma. A stenosed pylorus has been found in about 7 per cent. of the cases.

The diagnosis of sarcoma of the stomach before operation is often impossible. There may be no gastric symptoms whatever. This condition, like all other forms of malignancy, produces rapid loss of flesh, anemia, weakness and later cachexia. Only an operative diagnosis is possible. Hemorrhage from the stomach and blood in the stools is a frequent occurrence, especially in the round-cell variety, although in sarcoma, as a rule, it is not as frequent as in cancer. Ulcer of the stomach may be considered, especially if there is a history of indigestion. The rapid wasting may suggest cancer. But sarcoma, unlike ulcer or cancer, does not give a long history of dyspepsia, and in sarcoma there are less likely to be symptoms

of obstruction. There is more liable to be a palpable mass in sarcoma. Vomiting occurred in 20 per cent. of the cases. Pain comes early and persists. The tumors are often large. In Cantwell's case the tumor weighed twelve pounds. The pedunculated variety, which projects into the lumen of the stomach, may produce intermittent obstruction and vomiting. Pain after food may simulate ulcer, but the long history which is so characteristic of gastric ulcer is absent in gastric sarcoma. Benign tumors of the stomach may undergo sarcomatous degeneration. One case report in the literature had had a tumor for years, which was thought to be an ovarian cyst. Operation revealed a sarcoma of the stomach wall. The tumor must have originally been benign, with recent sarcomatous change. However, every palpable mass in the stomach region should rest under the suspicion of malignancy. The rapid development of anemia and debility, with loss of weight and cachexia, with early, rather severe and more or less persistent pain in the epigastrium, and the absence of any long-standing history of dyspepsia and obstruction (pyloric), is very suggestive of sarcoma. A palpable mass and bloody vomitus, together with melena, is all the more suggestive. Vomiting of blood in a young person, with or without severe pain, and a palpable epigastric tumor without obstruction, is suggestive of sarcoma. If the tumor mass is large in a middle-aged person and not associated with the usual symptoms of carcinoma of that size, sarcoma should be thought of. With the increasing employment of radiography as a routine in stomach disorders, relatively few cases of this condition, as rare as it is, will escape detection as an anatomic lesion requiring operation. This diagnostic means, as in carcinoma, if employed early, will be of value, and the too well-known classic but hopeless advanced symptoms formerly enumerated as diagnostic should not be waited for but early exploration should be invoked.

Mortality. The outcome was given in 64 cases. Twenty patients are recorded as having died, 3 as having recurrence and 41 patients recovered and were reported well at varying times after operation, the longest cure being a case of Rupert's,

a lymphosarcoma, who lived twelve years. Overton's patient is alive ten years after operation; Krause's patient seven and one-half years; Kimpton's five years and ten months, and one of Mayo's patients was known to be alive four years after operation. This patient had a spindle-cell sarcoma. The other three were of the round-cell type.

Case Report

Case 8140. Miss R. H., aged seventeen years, a schoolgirl, came for vomiting of blood and melena. There was a history of a very copious gastric hemorrhage occurring over a year ago and lasting a few days. It was arrested for two days, then recurred and was almost fatal. It was preceded by headache for a month. Blood was noticed in the stools for a week before the vomiting of blood. Three weeks after the hemorrhage a small tumor, apparently the size of a lemon, was noticed in the apex of the epigastrium. It was palpable for about a month and then it could not be made out again. The melena returned two weeks ago and reappeared one week before admission, and was associated with weakness but never any pain. She was quite pale and very weak.

X-ray examination showed what appeared to be a perforating ulcer of the lesser curvature, reported as an extruding defect on the lesser curvature about the size of a cherry. Hemoglobin was 40 per cent. Red cells, 2,150,000. Blood transfusion was followed in a few days by abdominal section under gas, showing an apparently malignant growth on the lesser curvature, the size of a child's fist, bluish, nodular and irregular in size, springing from the stomach, with little or no extension to the glands. It was quite favorable for resection.

After a second transfusion the hemoglobin rose to 56 per cent. and the red cells to 3,000,000. Partial gastrectomy, including tumor, was performed March 17, 1919, by the Polya precolic method. The postoperative progress was satisfactory for the first few days, when slight vomiting increased, persisted and became uncontrollable in spite of repeated lavage and

continuous proctoclysis, etc. By the seventh day vomiting was incessant, prostration was extreme and the general condition critical. There was no evidence of peritonitis. The vomiting was considered as mechanical and reoperation was reluctantly decided upon. It was obvious that interference would be very hazardous, as her pulse had become very weak, 140; the patient appeared quite desperate; 700 cm. of citrated blood were given, her pulse came down to 96 and she never vomited again but once. The hemoglobin after transfusion was 70, red cells 3,780,000. The plan of reoperation was happily abandoned. The explanation of the vomiting is probably acidosis, but the proof is lacking. The vomiting was regarded so certainly as obstructive that the routine examination for acetone was not ordered. The day after transfusion acetone was absent. The patient made a complete recovery and is now quite well.

Pathologic Report. Miss R. H. Date March 23, 1919. Serial No. 2873. Referred by Dr. Haggard. Source of specimen: Tumor from stomach. Time removed: March 17, 1919.

Gross Pathology. Specimen consists of a part of the stomach extending from the pyloric region upward for a distance of 10 cm. along the greater curvature. Attached to the lesser curvature is a soft nodular, apparently cystic tumor (Fig. 1). The greater portion is dark-colored, as though the cystic spaces contained blood. The surface of the tumor also shows adhesions to the serosa of the stomach separate from the main point of attachment. Projecting into the lumen of the stomach are several fairly firm, smooth nodular masses. A large one blocks the pylorus (Fig. 2). These are covered with mucosa and on section are grayish red and cellular, resemble thyroid gland on section. The mucosa of the stomach shows several small gelatinous nodules. *Miscroscopic Pathology.* Sections were taken from the nodules which projected into the stomach. The mucosa shows no change. The greater portion of the submucosa intervenes between the tumor and the mucosa. The tumor consists of a very cellular tissue, with very few definitely formed intercellular fibers (Fig. 3).

The cells are principally of the embryonic connective-tissue type. There are also numerous smooth muscles. There are a few lymphocytes. Some of the connective-tissue cells are oval in shape, others are more spherical. There were only two mitotic figures found. The tumor is evidently not growing rapidly.

Diagnosis. Fibromyosarcoma.

(Signed) Dr. A. M. Rosson.

"The sections of tumor of the stomach which you sent me I would interpret as a leiomyosarcoma (Fig. 3).

"The tumor tissue is composed of rather small spindle cells, with small hyperchromatic nuclei and cytoplasm which is rather opaque and eosinophile. The cells are arranged irregularly, but in some places they are grouped in small clusters often about a minute bloodvessel. This feature is occasionally seen in cellular uterine myomas. The stroma is very scanty except about the outskirts of the tumor. There are no signs of necrosis. I should not expect this tumor to metastasize nor to recur locally if completely removed, but its cellular character deserves the histological designation as sarcoma."

James Ewing.

Douglas in an excellent review of the subject added 3 personal cases to the former collection of Formi (1914), and Medina and Egana, together with 18 cases from the literature, aggregating 92 operative cases. In addition to these, I have analyzed 13 unpublished cases from the Mayo Clinic (2 of these were quoted by Douglas as reported by Huntington, as personal communications) and 1 additional case each by McWhorter, Pagenstecher, Basch and the writer, making a total of 107 patients operated on. Pagenstetcher's case was referred to by Douglas as a necropsy, but it appears that an exploratory laparotomy had been done twelve days before death. Of the 107 cases, 80 had partial gastrectomies or resections of the tumor and part of the stomach wall; 27 had explorations or

gastro-enterostomies. Of 58 partial gastrectomies 15 died, a mortality of 25 per cent. Of 10 exploratory operations 8 died in the hospital; 1 was reported to be in poor health after four months and the remaining one was not heard from after two months.

The thirteen cases of sarcoma of the stomach operated on at the Mayo Clinic between 1908 and August, 1920, are herewith briefly abstracted.

Case 18165. A woman, aged thirty-eight years, had noted an abdominal tumor for the past three years. She had nausea and lack of appetite, with gaseous eructations for two months. She had three one-day periods of gastric pain. At operation a tumor 20 cm. in diameter was found arising from the greater curvature of the stomach. Partial gastrectomy was done and the patient made a good operative recovery. Diagnosis: Fibrosarcoma. Patient died six months after operation.

Case 53972. A man, aged sixty-two years, during a period of four years had three attacks of pressure and pain in the epigastrium. Nine months previous to examination he had a three days' attack of nausea and vomiting, with slight hematemesis. At exploratory operation a lesion was found located at the fundus of the stomach and there were extensive metastases. A small section of the gland was taken for diagnosis. His immediate recovery was good, but when last heard from, four months after operation, he was in poor condition. Diagnosis: Sarcoma.

Case 82074. A man, aged forty-four years, for four weeks had had pains in the epigastrium and had noticed an abdominal tumor for one week. At operation a tumor was found involving the greater curvature and also the transverse colon. The origin of the tumor was doubtful. Partial resection of the stomach was done and the patient made a good recovery. Four years later he reported as well. Diagnosis: Spindle-cell sarcoma.

Case 182060. A boy, aged sixteen years, had had continuous pain in the left side with indigestion and gas an hour after eating for four months. At operation a tumor was

Fig. 1.—Sarcoma, lesser curvature of stomach.

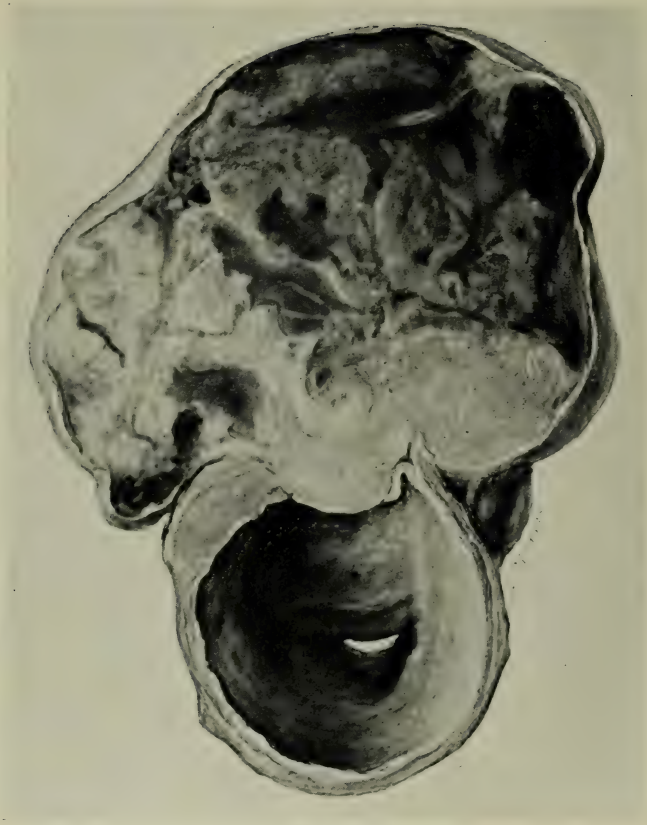

FIG. 2.—Cross-section of sarcoma, lesser curvature of stomach.

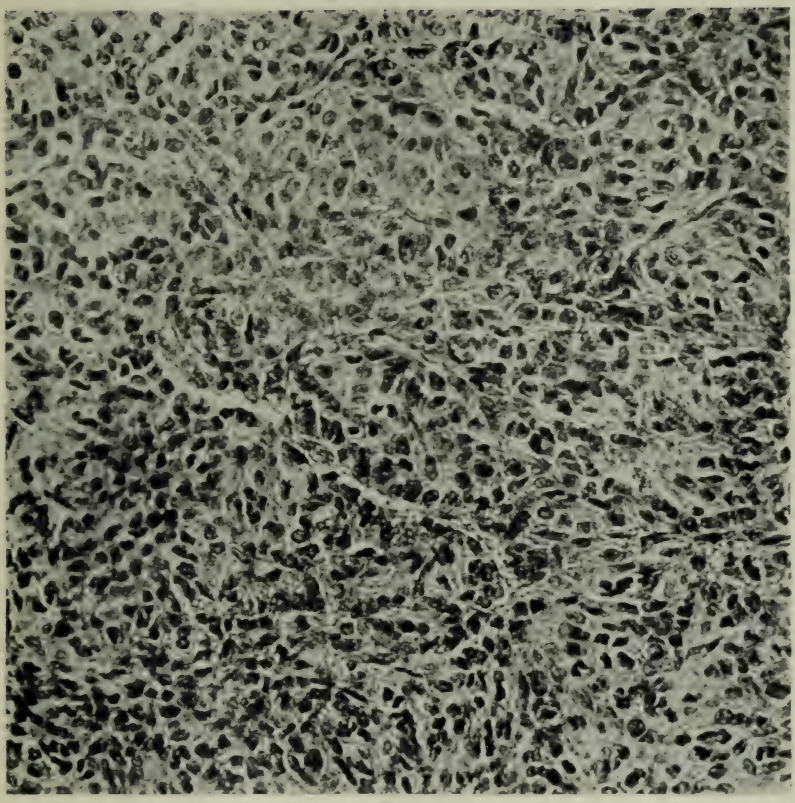

Fig. 3.—Microscopic section of sarcoma, lesser curvature of stomach.

excised from the posterior wall of the stomach. The patient made a good recovery, but has not been heard from since. Diagnosis: Lymphosarcoma.

Case 188936. A man, aged sixty-two years, had an occasional pain in the epigastrium for six months. Exploration was made for diagnosis and a lesion was found involving the lesser curvature and pyloric end of the stomach. Partial gastrectomy was performed. The patient made a good operative recovery, but has not been heard from since two months after operation. Diagnosis: Lymphosarcoma.

Case 204520. A woman, aged forty-four years, had annoying epigastric pains for seven years, with moderate gas eructations. No tumor was found on examination. At operation the posterior wall of the stomach was involved and a Polya resection was done. Good operative recovery. No report since. Diagnosis: Myosarcoma.

Case 205800. A man, aged fifty-three years, had had a bloating and indigestion for thirty years, with an exacerbation for three weeks previous to examination. No tumor was made out on examination. The pylorus was found to be involved at operation and an anterior Polya resection was done. Good operative recovery, but died at the end of four months. Diagnosis: Lymphosarcoma.

Case 265434. A man, aged forty-two years, had had epigastric distress with gas eructations and slight vomiting for four months. At operation the lesser curvature was involved and a subtotal gastrectomy was done. The patient died three weeks after operation. Diagnosis: Lymphosarcoma, with glandular involvement.

Case 282682. A man, aged sixty-six years, had gradually weakened for two years. He vomited a pint of blood one month before operation. He had noticed an abdominal tumor for one year. Through the abdominal wall the tumor felt very much like a spleen. At operation the tumor was found originating from the lesser curvature. Partial gastrectomy was done. The patient reported well nine months after operation. Diagnosis: Mixed-cell sarcoma.

Case 309588. A woman, aged forty years, had noticed an abdominal tumor for one year. For seven months she had had attacks of abdominal pain, nausea and vomiting, but never any blood in vomitus. A tumor was found involving the pylorus. A partial gastrectomy was performed. The patient made an immediate good recovery. Diagnosis: Myosarcoma.

Case 289467. A woman, aged sixty-two years, had had epigastric pain, with distention of the epigastrium without gas, for eight weeks. She had a poor appetite. At operation a lesion was found involving the lesser curvature and the posterior wall of the stomach. A partial gastrectomy was performed. The patient died seven days after operation. Diagnosis: Lymphosarcoma.

Case 190100. A man, aged forty-six years, complained of pain in the chest with periodic distress in the stomach and occasional vomiting. He had lost twenty pounds. A lesion was found involving the lesser curvature and a partial gastrectomy was performed. The patient recovered. Diagnosis: Lymphosarcoma.

Case 316187. A man, aged forty-seven years, had had gas eructations with gnawing epigastric pain after meals for one year. The lesser curvature was involved. A partial gastrectomy was performed. Recovery. Diagnosis: Lymphosarcoma.

Bibliography

1. Amelung: Berl. klin. Wchnschr., 1913, i, 567.
2. Allessandri: Mitt. a. d. Grenzgeb. d. Med. u. Chir., 1903, xii, 455.
3. Baldy: Jour. Am. Med. Assn., 1898, xxx, 523.
4. Barrington: British Jour. Surg., 1916, vol. iv.
5. Basch: New York Med. Jour., 1920, cxii, 9.
6. Bird: Intercol. Med. Jour., p. 103.
7. Billroth: Wien. med. Presse, 1888, Nos. 4 and 5.
8. Burty: Paris Chir., 1914, p. 731.
9. Capello: Centralbl. f. Chir., 1899, vol. xx.
10. Cantwell: Ann. Surg., 1899, xxx, 596.
11. Glendenning: Am. Jour. Med. Sc., 1909, vol. cxxxviii.
12. Dickinson: Jour. Am. Med. Assn., 1909, vol. liii.
13. Dock: Jour. Am. Med. Assn., 1900, vol. xxxv.
14. Douglas: Ann. Surg., 1920, lxxi, 628.

15. Erdman: Ann. Surg., 1910, xix, 122.
16. Ewing: Neoplastic Diseases, pp. 254 and 374. Philadelphia: Saunders, 1919.
17. Fenwick: Cancer and Other Tumors of the Stomach, London, 1902, p. 274.
18. Finlayson: British Med. Jour., 1899.
19. Flebbe: Frankfort Ztschr. f. Path., 1913, xii, 311.
20. Formi: Riforma med., 1914, xxx, 624.
21. Frazier: Am. Jour. Med. Sc., 1914, cxlvii, 781.
22. Fritzesche: Cor.-Bl. f. schweiz. Aerzte, 1918, xlviii, 1273.
23. Geymüller: Deutsch. Ztschr. f. Chir., 1917, vol. cxl.
24. Giacoma: Riforma med., 1915, xxxi, 148.
25. Gossett: Presse méd., 1912, p. 221.
26. Hartley: Ann. Surg., 1896, xxxiii, 609.
27. Hartz: Surg., Gynec. and Obst., 1914, xviii, 502.
28. Herman: Tr. Obst. Soc., 1901.
29. Hesse: Zentralbl. f. Grenzgeb., 1917, vol. xv.
30. Huntington: California State Jour. Med., 1914, xix, 482.
31. Kimpton: Boston Med. and Surg., Jour., 1919, clxxxi, 731.
32. Koettlitz: Arch. med. Belge., 1919, lxxii, 136.
33. Kondring: Zentralbl. f. Gynäk., 1913, xxxvii, 417.
34. Krause: Deutsch. med. Wchnschr., 1911, xxxvii, 2058.
35. Lemormant and Lecene: Bull. et mém. Soc. Anat., 1909, vol. lxxxiv.
36. Levine: Ann. Surg., 1919, lxx, 561.
37. McCormick: Scotland Med. Jour., 1906.
38. Mayo: Personal communications.
39. Maylard and Anderson: Ann. Surg., 1910, lii, 506.
40. Manges: Mt. Sinai Hosp. Rep., 1907.
41. Medina and Egana: Rev. d. l. assoc. med., Argentina, 1917, xxvi, 309.
42. Moschowitz: Ann. Surg., 1912, vol. lv.
43. Moser: Deutsch. med. Wchnschr., 1903, vol. cxxxiii.
44. McWorter: Surg. Clinics of Chicago, 1919, iii, 1029.
45. Overton: Southern Med. Jour., 1911, iv, 838.
46. Pagenstecher: Proc. New York Path. Soc., 1919, xix, 137.
47. Piere: Policlinico, 1910, xvii, sez. chir., 137.
48. Rohdenberg: Proc. New York Path. Soc., 1917, xvii, 138.
49. Rupret: Wien. klin. Wchnschr., 1903, vol. cxxxiii.
50. Saito: Verhandl. d. Japan Path. Gesellsch., 1916, vi, 185.
51. Schlesinger: Wien. klin. Wchnschr., 1915, xxviii, 895.
52. Scopf: Centralbl. f. Chir., 1899.
53. Scudder: Ann. Surg., 1913, lviii, 252.
54. Skerrill: Surg., Gynec. and Obst., 1915, xxi, 443.
55. Saltykow: Verhandl. d. Deutsch. path. Gesellsch., 1910, vol. xiv.

56. Swearinger: Washington Med. Ann., 1910–1911, ix, 162.
57. Schlesinger: Wien. klin. Wchnschr., 1916, xxix, 785.
58. Smithies and Ochsner: Cancer of the Stomach, Philadelphia, Saunders, 1916, p. 412.
59. Von Eisselsberg: Deutsch. med. Wchnschr., 1903, xxxiii, 1.
60. Von Graff: Wien. klin. Wchnschr., 1912, xxv, 1005.
61. Warner: Ohio Med. Jour., 1917, xiii, 647.
62. Yates and Ochsner: Ann. Surg., 1906, xliv, 509.
63. Ziesche and Davidson: Mitt. a. d. Grenzgeb. d. Med. u. Chir., 1907, xx, 377.
64. Zesas: Quoted by Gossett.

THE TREATMENT OF DUODENAL FISTULA

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The increase in surgery and the more radical work now being done in the upper right abdomen have undoubtedly been attended by the production of many cases of traumatic duodenal fistula. While the aggregate number is large, no considerable number have developed in the practice of any one surgeon, hence very little has been written on the subject. This is to be regretted, as the condition is a serious one, and the best method of dealing with it has not yet been clearly settled.

Duodenal fistula usually follows operations on the duodenum or injuries to the duodenum in the course of operations on the gall-bladder or kidney. They sometimes develop immediately, but more often are first noted four or five days after an operation at a time when the patient is supposed to be out of danger. This is due to stitches giving way or to tissue strangulated by a ligature or forceps undergoing sloughing. The discharge of duodenal and stomach contents may begin gradually and be small in amount, or it may begin suddenly and comprise all liquids and food taken by mouth and all the secretions of the stomach, liver and pancreas. If the fistula is small and the discharge is scant the opening may close spontaneously and the patient recover; but usually the destructive action of the digestive secretions causes the fistula to enlarge, and unless there is surgical intervention the patient dies. The excoriative effect of the discharges on the wound and adjacent skin, the inability to retain nourishment taken by mouth, and above all the rapid loss of body fluids cause the patient to lose strength

and weight in an alarming way. Often in a few hours the facial expression is so changed and the tissues of the body are so shrunken that it is difficult to realize that it is the same individual.

There are few conditions in surgery that require more courage and wisdom to meet properly. Courage, because a prompt operation must be done under unfavorable conditions on a patient who was thought to be safely convalescent; and wisdom, because the best surgical procedure is not settled, and different methods have to be adopted to meet different indications.

If the discharge is small or moderate in amount and the patient's general condition is good the fistulous opening may be plugged with gauze, little or no food or drink given by mouth, and the patient sustained by nutritive enemata, with the hope that the opening in the duodenum may heal spontaneously. This conservative plan of treatment should not be continued if the patient loses strength rapidly, but more radical measures should be resorted to before it is too late.

Direct attack and suture of the opening in the duodenum are feasible in some cases but hopeless in others. If the fistula has followed a nephrectomy and is due to injury inflicted on the posterior wall of the bowel, then the plan suggested and practised by W. J. Mayo is the logical one. The abdomen should be opened by an upper right rectus incision and the duodenum exposed by retracting the gall-bladder and liver up and drawing the hepatic flexure and transverse colon down. An incision is then made through the peritoneum to the outer side of the duodenum and the bowel carefully separated from its posterior attachment. When the fistulous opening is exposed it can be easily and securely sutured.

If the fistula is on the anterior wall of the duodenum and has occurred as a complication after an operation on the gall-bladder or stomach the conditions render an attempt at direct closure almost hopeless. The presence of infection makes manipulations dangerous, the existence of adhesions makes exposure difficult, and the inflamed and necrotic state of

the bowel wall makes satisfactory coaptation with sutures impossible.

Deaver and others have dealt with the condition just described by doing a posterior gastro-enterostomy with or without closure of the pylorus. This sidetracks the opening in the duodenum and prevents the escape from the intestinal tract of fluids taken by mouth. The operation is especially advisable in cases in which the fistula is the result of an ulcer of the duodenum, as it not only meets the immediate indications but also eventually cures the primary disease. It is an operation of some magnitude, however, and cannot be done without risk on a seriously ill patient, and it results in an anatomical abnormality that is to be regretted in many cases.

Recently I had a large duodenal fistula suddenly to develop in a woman whose condition was such that a gastro-enterostomy could not be considered. The emergency was met by doing a simple jejunostomy and feeding her by the introduction of food into the intestines at a point below the fistulous opening. The procedure may not be original, but I can find no reference to it in the superficial examination I have been able to make of the literature of the subject, and I have, therefore, decided to report the case:

Mrs. B., thirty-two years of age, entered St. Luke's Hospital July 21, 1919. She was very emaciated, deeply jaundiced and had pulse and temperature indicating septic infection. She said that eight months before admission she had a sudden attack of abdominal pain that was shortly followed by jaundice which had persisted with little or no variation. Four months ago she had been subjected to an operation, but the surgeon had not been able to locate and relieve her trouble. He told her that he found and separated many adhesions about the liver, but that he could not palpate a stone and, therefore, did not open the gall-bladder or common duct. The patient's general condition made her a bad surgical risk, but as it was evident she would die unless she was given relief an operation was undertaken after acquainting the family with the danger attending it.

The abdomen was opened through the scar of the old incision in the upper right rectus. As anticipated, dense and widespread adhesions were found which were carefully and systematically separated. A small, thick-walled gall-bladder containing several stones was finally reached, but in freeing it a hole was torn in the duodenum. As it was thought the opening might prove of use in the course of the operation, it was not closed at the time but plugged with a piece of gauze. The common duct was next located. It did not contain a stone and was not dilated, as had been expected, but was empty and contracted. It was opened and a probe passed down it to the duodenum, where it could be seen emerging at the ampulla of Vater. The probe was then passed up toward the liver, and a stone was found at the bifurcation of the hepatic ducts. The stone was extracted, and there was at once a copious flow of bile. The gall-bladder was removed, the opening in the duodenum sutured with a double row of chromic catgut stitches and the common duct drained by a tube sewed in its lumen with protective gauze and rubber tissue placed about it.

The patient stood the difficult and rather prolonged operation unusually well, and her progress for a time was very satisfactory. On the ninth day, however, there was a sudden and profuse discharge of gastric contents through the incision, and it was evident that the catgut sutures in the duodenum had given way and a large duodenal fistula had resulted. Water and liquid food taken by mouth escaped through the wound almost as rapidly as swallowed, and the patient's condition soon became desperate. She seemed actually to shrivel and shrink while under observation. It was obvious that something had to be done and done promptly. A direct attack on the fistula was hopeless, owing to the condition of the tissues and a posterior gastro-enterostomy, with occlusion of the pylorus was hopeless, owing to the condition of the patient. The only alternative that suggested itself was a jejunostomy.

Under gas-oxygen anesthesia a new incision was made in the midline and the operation done by the technic described by Charles H. Mayo. The initial loop of the jejunum was brought

into the wound, a small incision was made opposite its mesentery, and a rubber catheter was inserted into its lumen. The catheter was retained in place by a purse-string suture and was infolded in the wall of the bowel for a distance of two inches after the method of Witzel. The omentum was then placed in its normal position so that it lay between the loop of bowel and the anterior abdominal wall, and a perforation was made in it through which the catheter was passed before it traversed the abdominal wall, to be secured by a suture to the cutaneous surface.

The operation was completed in a few minutes, and the patient was given a pint of fluid through the tube before she was removed from the table. The result was immediate and gratifying. All discharge except bile through the drain in the common duct shortly ceased and the patient's general condition rapidly improved. She was given water and nourishment exclusively through the catheter and nothing so introduced escaped through the fistula. At the end of ten days the drain in the common duct was removed, and in three weeks the primary incision had spontaneously closed. Feeding was cautiously begun by mouth, and, as it caused no trouble, the tube in the jejunum was taken out. The second incision closed promptly without leakage, and the patient was ultimately discharged from the hospital, having been relieved of her symptoms and having gained twenty pounds in weight.

DISCUSSION ON THE PAPERS OF DRS. HAGGARD AND McGUIRE

Dr. S. M. D. Clark, New Orleans, Louisiana.—When one has encountered a duodenal fistula its discussion always arouses his interest. I have had 2 such cases: The first was in a man, aged fifty years, in whom I removed a very adherent gall-bladder filled with stones. Upon leaving the hospital on the twelfth day he had a very small drain from a tiny opening in the upper angle

of the wound. Five days after going home, or seventeen days after the operation, I was called and found that after a severe coughing an active clear fluid started flowing from the small tract and was continuous. The fluid ran freely, soaking numerous gauze pads; the patient rapidly weakened and he looked dreadfully; his pulse ran to 140 and his expression was anxious. He was very thirsty and in all terribly depleted. He was taken to the hospital and as a "trusting to God" measure I firmly packed the small tract with gauze. He was delighted and I surprised that no more leak occurred, and next day he was in fine spirits. Three days after the pack was "prayfully" removed and he has never had the slightest trouble since. I have no idea how this fistula originated, but it came on seventeen days after the operation and healing spontaneously from the pack. The second case was not so fortunate. It was in a case in which a cholecystotomy was performed four months previously for a very acutely infected gall-bladder. There was temporary relief, but upon the return of symptoms a cholecystectomy was attempted. It was an exceedingly difficult case. All anatomical guides were gone; in fact, there was a conglomerate, tangled mass. I recalled Dr. George Crile working in such a case when he said that he was looking for the greenish fluid, and, if it came to view, then he knew it was the gall-bladder. Sticking close to the liver and keeping the Crile suggestion in mind, I came across a viscus having a greenish fluid on the other side. Upon opening this I found that it contained bile, but I had invaded the duodenum. This was closed and the gall-bladder found and removed. On the third day after the fistula started and ran copiously. Ten days later I did a jejunostomy under local anesthesia, but to no avail, the patient dying two days later.

Dr. William M. Jordan, Birmingham, Alabama.—I have been very much interested in these two papers, and particularly in Dr. Haggard's able review of cases of sarcoma of the stomach and the report of his case. I want to mention a case of sarcoma of the stomach that occurred in my own practice. The patient was a woman, aged thirty-five years, upon whom I operated eight years ago last month, on November 15. The tumor in my case was much more favorable for operation than the one Dr. Haggard has described and shown in his pictures. It was a

freely movable pedunculated growth about the size of a pear. The mucous membrane was not involved, and one feature of the case was the almost complete absence of symptoms. There were signs of discomfort in the abdomen and dragging, and the obvious evidence of a neoplasm in the abdomen. Before the operation I was thinking of something in the lower right abdomen, and was surprised to find the tumor growing from the stomach. The tumor hung from the lesser curvature. I removed it by resection. I applied a ligature to the epiploic vessels and removed the growth by a V-shaped incision. When I saw Dr. Haggard was going to read a paper on this subject, I tried to get data to send him a report of my case, but I had some difficulty in finding out whether the patient was still living or not. I finally got a letter from her, which was too late to send to Dr. Haggard. She is still in good health, eight years and one month after the operation.

As to the subject of duodenal fistula, postoperative, I had the misfortune to have had a very large duodenal fistula following a nephrectomy for a large tuberculous kidney in December, 1915. At first I was at a loss as to what was wrong until I got hold of a paper by Dr William J. Mayo, published in January of that same year reporting 3 cases, and suggesting as a probable cause injury by forceps. However, in my case no forceps was used, and I concluded the large tear in the duodenum was caused by traction on the bands of organized fat. I did a secondary operation, going through the rectus muscle, mobilizing the duodenum and closing the rent. Twenty-four hours after the secondary operation the woman went into a condition resembling acute mania and died. I was struck with the amount of damage done by the pancreatic fluid in the nephrectomy incision, the lumbar muscles and retroperitoneal tissues.

Dr. Charles H. Mayo, Rochester, Minnesota.—I shall not discuss Dr. Haggard's paper on sarcoma of the stomach because he knows more about our own cases than I do, since he has the report. He spoke about vomiting. In the past year we have arrived at a series of explanations why operations in the upper abdomen cause vomiting. We have noted a most interesting feature lately in a number of cases in which there was vomiting about the eighth or ninth day after gastric operation which so

exhausted the patients that some of them died. The amount of blood urea was three or four times normal. The question arose as to whether the patients should not be treated primarily for the uremic condition because of the changes in the urine and the high urea content of the blood instead of primarily for a gastric complications. Another point I should like to speak of is the cause of vomiting after operation. We turn patients over on their faces because vomiting stops, in some patients, the minute they are turned over. The reason for this lies in the fact that the circulation and congestion is relieved at the point where the duodenum ends and the jejunum begins. According to recent work the length of the duodenum varies greatly in different persons. It may descend for several inches, fold back on itself, and cross the spine. When gastro-enterostomy is done through the mesentery of the transverse colon there is chance for obstruction; and it is in such cases that the patients are relieved by being turned on their faces.

Dr. McGuire brought up a most interesting question as to the use of jejunostomy after duodenal fistula. In a case such as he described it was undoubtedly the best procedure. In most cases the patient will be in a better condition for closure of the duodenal fistula as the result of the preliminary jejunostomy.

Dr. J. Shelton Horsley, Richmond, Virginia.—There is one point I should like to speak of, namely, the possibility of prophylaxis. Postoperative duodenal fistulæ frequently occur when the duodenum has been injured after operations on the gall-bladder in which drainage has to be instituted. We all know if you drain a sutured bowel a fistula often results, and it is probably because of the fact that the lymphatic circulation in the neighborhood of the drain is reversed toward the drain, and consequently there are only thin lymphatic deposits over the sutures. The chief method of healing of a sutured bowel wound is by a deposit of lymph which may be diverted by the drain. With the drain near the duodenal wound fistula is likely to occur. I have never had a case of fistula from the duodenum, but I have had injuries, and have had occasion to cover raw surfaces of duodenum after the removal of the gall-bladder. On one occasion the condition was such that I could not use the surrounding tissue and I grafted by free transplant from the

omentum. That is a prophylactic because the free graft of omentum over the sutured duodenum protects the healing duodenum from the presence of the tube on the one hand, and induces a larger flow of lymph on the other.

Dr. Haggard (closing the discussion).—In connection with what Dr. Mayo has said about vomiting, I have turned these patients on their faces, presuming we had acute dilatation of the stomach. I was so obsessed with the idea throughout of mechanical interference that in the first case I was sorely tempted to interfere; if I had, I would have lost my patient. In a lucid interval I gave this girl transfusion of blood and saw she got so much better. She had vomited eighteen times that afternoon, and after I gave her a blood transfusion she vomited only once. I thought she had acidosis. I did not find the acetone bodies. If I had, I should say it was terminal, and not exhaustive. I do not know what caused the vomiting, but I do know if it had not stopped she would have been a corpse. I attribute the cessation of vomiting to the transfusion, and also to not interfering any more.

TWO CASES OF RECKLINGHAUSEN'S DISEASE, WITH SURGICAL COMPLICATIONS

By Charles E. Caldwell, M.D.
Cincinnati, Ohio

Under the title of von Recklinghausen's disease is included a variety of conditions, fibroma molluscum, neurofibroma, plexiform neuroma. That all these conditions are dependent upon a constitutional vice, probably some abnormality in the endocrine glands, is not unreasonable to assume. A rather extensive survey of the literature leads one to the conclusion that the skin picture formerly known as fibroma molluscum and, since von Recklinghausen's thesis in 1882, as neurofibroma of the skin, is associated with, and often seriously complicated by, other conditions. For this reason von Recklinghausen's disease is no longer to be regarded as a local disease of the skin, but simply as one manifestation of a general or constitutional vice.

These patients are not infrequently of a low grade mentality; there is usually about them something which for want of a better term we might call freakish. The facial features are often exaggerated in size, or lacking in symmetrical proportion. Coexistent with the tumors of the skin, which are quite characteristic, a pigmentation is present sometimes sufficiently marked to suggest Addison's disease. Psychoses of a more or less marked character are present in a considerable number of cases. Tumors of the peripheral nerves, and less frequently of the central nervous system, are found. Skeletal changes and muscular dystrophies occur not infrequently. Tuberculosis is a not infrequent complication. A distinct

tendency for cases to belong to the family type has been noticed (1).

Up to the present time nothing has been accurately determined as to etiology, but it is not unreasonable to assume that some one, or more, of the endocrine glands plays a part. In cases of neurofibromata of the peripheral nerves, sarcomatous changes may occur, usually of the myxosarcomatous type, and not disposed to form metastases (2). Neurovascular changes may occur, and one of the cases which I report may have presented such a condition.

It is not the purpose of this paper to enter into a detailed description of von Recklinghausen's disease nor to advance theories as to its causes. What particularly concerns us are such accompaniments of the disease as demand surgical interference. Of these the most conspicuous are neuromata or, more properly speaking, fibroneuromata arising either from the nerve sheath or neurilemma, or from the nerve itself. Unfortunately for the patient, these fibroneuromata are often multiple and invade either a single nerve in large numbers, or are disseminated over various peripheral nerves.

The type known as plexiform neuroma is much less common and may be found in the central nervous system, notably the brain, where it may take on the appearance of a glioma. The tendency of some of these neuromata to undergo sarcomatous change has already been noted. In the event of a single large neurofibroma affecting a single nerve trunk, symptoms of pain and interference of function may warrant surgical intervention. Such a condition is presented in one of my cases.

Von Recklinghausen's disease is not of extreme rarity, and quite a number have come under my notice. In only two have the complications been of a surgical nature, and I take the liberty of relating their history.

Case 1. Jennie J., age fifty-eight, female, white; admitted Cincinnati General Hospital, May 27, 1919; discharged August 4, 1919. The patient is a poorly nourished, poorly developed woman. The facial expression is indicative of low grade mentality; ptosis of both eyelids; pterygium in both

eyes; typical picture of von Recklinghausen's disease; multiple neurofibromata over face and body.

Present Complaint. Generalized aching, poor eyesight, lumps on body.

Present Illness. The patient cannot give accurate history, especially as to time and place. She says her eyesight has been poor ever since she was eleven years old, when a doctor operated upon her; cannot state definitely when the growth over the cornea began. The mentality is evidently very low. The lumps on her body began some years ago as "just simply lumps and kept coming," until now they are spread over the entire body. Some lumps have grown larger than others, but none has caused her any trouble except a very large swelling in the under side of the left arm. This causes pain to pass down along the ulnar side of the arm into the fingers innervated by the ulnar nerve. The pain is more marked when the patient does heavy work, such as washing, etc. The patient now complains of indefinite aching sensations throughout the back, limbs and anterior part of the chest. No definite type of pain can be elicited but simply a dull aching pain.

The patient has headaches in the occipital region. The headaches are severe, accompanied by nausea and vomiting, last two or three days, and occur "every once in a while." The patient has difficulty in walking because of the eye conditions. She occasionally suffers from edema of the limbs and slight shortness of breath. She does not urinate at night and has no burning. She has a slight hacking cough and expectorates a thick tenacious sputum in moderate amounts, occasionally expectorating a bloody sputum. She has no night sweats. The appetite is poor. The patient has difficulty in swallowing and occasionally suffers from gastric distress. The bowels are irregular; she uses salts occasionally. She has no jaundice and no melena.

The patient claims she had "scrofula," measles, mumps and smallpox as a child; tonsillitis occasionally. She gives no traumatic history although there is a question as to the left ankle having been broken.

Fig. 1.—Case 1.

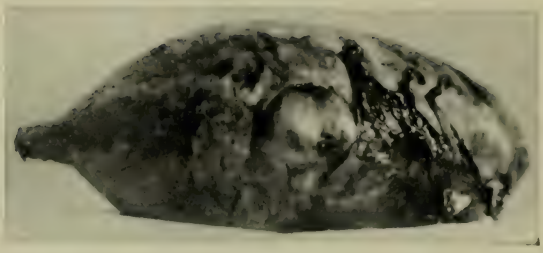

FIG. 2.—Case 2. Fibroma of ulnar nerve, one-third natural size.

FIG. 3.—Case 2. Gluteal tumor.

The father and mother both are dead, the father having succumbed to Bright's disease and the mother to an unknown cause. One brother is living and well; one brother died two years ago from Bright's disease; two sisters are living and well; one sister died from cardiorenal disease. The family history reveals no history of tuberculosis, cancer, or mental disease.

The patient is single, gives no history of miscarriage, and denies venereal disease. She takes whisky as "toddy" occasionally; drinks no beer, but does take coffee and tea—about three cups a day. She has done housework all her life.

Physical Examination of Surgical Condition. Scattered over the trunk and limbs of the patient are numerous, irregular soft, fat-like masses, varying in size from that of a small pea to that of a walnut. These masses are more pronounced over the nipple region of each breast and along the anterior part of the chest and abdomen. In the left epigastric region, just beneath the costal border and about 1.5 inch from the mid-line, is a soft, round, globular fat-like mass about the size of a small egg, not painful or fluctuant. Along the posterior aspect of the left triceps muscle is an elliptical, sausage-like, rounded, smooth mass about 12 centimeters long and apparently 5 centimeters in thickness. The mass is freely movable beneath the skin, and does not change position upon contraction or relaxation of the muscles of the arm. Upon palpation, the patient states she has a tingling sensation down the ulnar side of the forearm and into the ring and small fingers of the left hand. There is a marked atrophy of both thenar and hypothenar eminences with a marked thinning of the interosseous spaces. There is a persistent flexion of the small and ring fingers (claw-hand). The left arm and forearm are atrophied to a considerable extent.

Operation, June 22, 1919. Local anesthesia (apothesine) was used. An incision about 10 centimeters in length was made along the inner border of the biceps muscle. The skin and fascia were severed. The tumor mass was found to be lying in the path of the great vessel of the arm, pressing on the

median nerve and brachial vessels. The basilic vein passed over the mass. We opened the fascial covering of the mass which was found to be a nodular enlargement of the ulnar nerve about 10 centimeters long. The nerve was exposed above and below the tumor mass, and the mass removed. The bleeding points were ligated and the fascia and skin closed with catgut sutures. The patient left the operating room in fair condition. She complains of severe pain in the left arm about the incision. She sleeps well, has vomited considerably since operation, but is not uncomfortable.

June 24, 1919. The patient apparently is very weak. She complains of lack of appetite. Eichberg's tonic was given. The patient has much pain in the arm which keeps her from sleeping. For the relief of this morphine was given.

June 27, 1919. The patient seems somewhat better and complains less of pain. She has some slight movement in the ulnar distribution of the hand; flexion is very poor.

June 29, 1919. The patient's condition is very good. She is up and about, and has little pain in the arm. She eats fairly well.

Pathological Report by P. G. Woolley. The tumor mass was preserved in formalin. It was ovoid, firm, elastic, measuring 13.5 by 7 by 6.5 centimeters. It had the appearance of being an encapsulated mass, the capsule being composed of fibrous tissue, the strands of which were arranged for the most part transversely to the long axis. At one pole was a teat-like projection that was evidently a section of a large nerve incompletely lobulated. An attempt to dissect the mass, commencing with the nerve trunk, was made and was unsuccessful, for it seemed that the sheath of the nerve was continuous with the capsule of the tumor, and that the nerve trunk itself disappeared. The appearance suggested, therefore, that the tumor itself had arisen within the trunk of the nerve and that the nervous tissue had been destroyed by the growth, or that the fibers had been so separated that there was more of the normal coherence. On section of the mass—a complete longitudinal section—it appeared that there was a

capsule quite distinct from the mass of the tumor, and that the latter was composed of fibrous tissue, which according to its position was clear white and hyaline (in the center); edematous and translucent (scattered). At one point near the pole to which the nerve fragment was attached, in the capsule, was an area of calcification. There was no microscopic evidence of nerve tissue. Tissue for histologic study was removed from four different points to represent all depths of the tumor mass.

The histologic sections all show practically the same changes in each. Such variations as are present relate to degenerative changes and to cellular infiltrations. The whole tissue is composed of fibrous tissue with no discoverable neural tissue. In the solid, firmer portions of the tumor this fibrous tissue is richly cellular and is infiltrated with numerous small round cells. In the softer portions the fibrous tissue which is formed of larger and smaller bundles is poor in nuclei, and the bundles are swollen and edematous. There are a few pale giant nuclei due to the edema. In the yellowish areas the fibrous tissue is undergoing degeneration and in these areas lime salts are deposited in smaller and larger amounts. There are numerous microscopic concretions. The capsule is composed of pure fibrous tissue.

Case 2. N. D., aged fifty, female; admitted to Cincinnati General Hospital, March 9, 1917. The patient is a fairly nourished, fairly developed white woman. The facial expression and manner are suggestive of psychical peculiarities. The family history is irrelevant. The patient has had the usual diseases of childhood. Her health is unusually good. For years she has had scattered over her body numerous small tumors, some sessile, others pedunculated. She presents a typical picture of fibroma molluscum or fibroneuroma.

For twenty years the patient has noticed a swelling in the right upper gluteal region, what she thought was fat. On February 8, at 11 P.M., the patient noticed that the swelling had become larger and was becoming painful. Since then it has continued to increase in size and is very painful. It now

presents a large and fluctuating tumor mass. Ecchymosis is present over the tumor mass. The blood count shows red cells, 4,240,000; white, 14,200. The pain in the tumor is increasing and involves the whole right thigh. The tumor was aspirated and a dark red fluid obtained. Ice caps were applied. The patient was under observation for five days. The temperature ran from about normal in the morning to from 100.6° to 101° in the evening.

March 16, the patient was operated upon. A large mass of apparently fatty or myoid tissue was removed. Hemorrhage was very free, necessitating the ligation of branches of the pluteal artery. The wound was closed with rubber tissue drain, and the patient was returned to the ward in good condition. The wound continued to drain blood and serum in slight amounts and the discharge had an offensive odor. The patient's temperature dropped to normal on the third day and remained so for several weeks, when, on April 10, her temperature suddenly went to 104°. She suffered an attack of erysipelas, and was transferred to the dermatological service, from which she was discharged well, May 7, 1917.

Pathological Report on Tumor, by Paul G. Woolley. The tumor is a mass of orange-colored fatty tissue filled with hemorrhages, which at once place is collected into a clotted mass that resembles that seen in aneurisms. There is no evidence of growth of the tumor tissue nor of the aneurismal wall. Sections of the tumor show no evidence of new growth, but merely fibroid adipose tissue in close diffuse association with large amounts of granulation tissue. There is no vascular or aneurismal wall tissue.

This rather unsatisfactory and indefinite protocol from a diagnostic standpoint has led me to believe that I was right in my surmise that this growth was the product of degenerative changes in a large neurofibromatous mass, with accompanying neurovascular changes. Before operating I had in mind one of those myxosarcomatous tumors which sometimes supervene in these neurofibromata. I am not yet convinced in my own mind that such was not the case.

One feature in this case which may have a bearing on the statement that relaxed musculature is an accompaniment of disease is that the patient had a left inguinal hernia which I subsequently operated upon and found a diverticulum of the urinary bladder in the sac, which had no covering of muscle fibers but consisted simply of a peritoneal coat. This led to the belief at first that I was dealing with a hydrocele of the canal of Nuck.

Bibliography

1. Palmer, Dudley W.: Von Recklinhausen's Disease, with Sarcomatous Degeneration, Lancet Clinic, cxii, 564.
2. Bunch, J. L.: Proc. Royal Soc. Med., x, 59.
3. Moschcowitz: Plexiform Neuroma, Ann. Surg., lx, 498.
4. Preizer, Samuel A., and Davenport, Charles R.: Am. Jour. Med. Sc., clvi, 507.
5. Delbanco: Deutsch. med. Wchnschr., xlii, 1173.
6. Klinger: Berl. klin. Wchnschr., xlix, 1491.
7. Lodovico, Gatti: Neurol. Centralbl., xxxii, 1027.
8. Frank, Elmer H.: Internat. Clinics, iii, 99.
9. Gould, Eric Pearce: Quarterly Jour. Med., ii, 221.
10. Anzinger, F. P.: Ohio State Med. Jour., xv, 424.

JOHN YOUNG BROWN, M.D.

IN MEMORIAM

JOHN YOUNG BROWN, M.D.

1865–1919

Dr. John Young Brown was born July 20, 1865, and reared in Henderson, Kentucky. He was a descendant of revolutionary stock, maternally and paternally. His mother, Rebecca Hart Dixon, was a daughter of Hon. Archibald Dixon and Elizabeth Robertson Cabell; his great-grandfather was Captain Wynn Dixon, of the Continental Line (W. C.), and was an original member of the North Carolina Society of the Cincinnati. His great-great grandfather was Colonel Henry (Hal) Dixon, of the North Carolina Continental Line, and was a very distinguished soldier, participated in many battles, was wounded three times and died from a wound received in the battle of Eutaw Springs. A monument, enumerating the names of battles in which he was engaged, was erected to his memory by the State of North Carolina on the battle-ground of Guilford Court House.

Dr. Brown's maternal great-grandmother, Rebecca Hart, was the daughter of David Hart. David Hart and his brothers, Nathaniel and Thomas Hart, were among the nine members of the Transylvania Company who in April, 1775, built Fort Boonesboro, in Madison County, Kentucky, thereby making possible the settlement of Kentucky by white men and the conquest of the Northwest territory by General George Rogers Clark in 1778–79—"a national domain," says the historian Fiske, "which at the most critical period of our history just preceding the formation of the Constitution proved to be the only available source of revenue left to the bankrupt colonies and the principal thread which held the Union together."

The Cabells of Virginia were descended from Dr. William Cabell, who was a member of the first House of Burgesses of Virginia. His maternal great-grandmother, Ann Bolling Cabell, wife of his great-grandfather, Joseph Cabell, was a direct descendant of Pocahontas. His grandfather, Archibald Dixon, was a distinguished lawyer, represented Kentucky in the State Senate, was Lieutenant-Governor and succeeded Henry Clay in the U. S. Senate. His father, John Young Brown, was a representative in Congress for several terms; the first term when he was only twenty-four years old, and was Governor of Kentucky. During the Tilden and Hayes contest he delivered the strongest philippic ever made in the House in his excoriation of Benjamin F. Butler.

Dr. John Young Brown's early education was received at McCabe's School, Virginia, and he was graduated in medicine at the Bellevue Hospital Medical College in 1887. For two years he studied with the late Dr. Joseph Price, of Philadelphia.

After practising his profession for a short time in the city of his birth he moved to St. Louis, Mo., where with rapid strides he came to the front. Soon after locating there he was appointed by Mayor Rolla Wells as chief surgeon of the St. Louis City Hospital, where he served for two terms. During this time his ability and originality in surgery became evident not only to the local profession but to other noted surgeons. His contributions to medical literature were of such high order as to cause widespread comment. They were characterized by a conservatism which made the reading of them important to the beginner in the practice of surgery, and he soon became recognized throughout the country as a surgeon of exceptional merit. From 1905 until the day of his death he was chief surgeon of St. John's Hospital.

He was a charter member of the American College of Surgeons and ex-President of the Southern Surgical Association, the American Association of Obstetricians and Gynecologists and the Mississippi Valley Medical Association. He also was ex-President of the Kentucky Society and a member of the local, State and national medical societies. During the Great War he accepted a commission as first lieutenant from the President and appointment as medical aide to Governor Gardner in the selective service drafts. He befriended all the men needing medical attention to fit them for service and arranged for free

hospital beds and operations without charge. He was also one of the fifteen original members of the General Medical Board, Council of National Defense, appointed by President Wilson, having charge of all the medical advisory boards in Missouri, with rank of Major.

The following extracts taken from the tributes by his friends in a little book entitled *In Memoriam*, will indicate far better than the writer can express the esteem in which he was held:

"The tributes from his friends are the expression of high regard. It is given to few men to impress others with the truth of their personality. Artifice thickly overlays the acts of most men, and the result is that it is impossible to get at the real man. Dr. Brown was divorced from artifice: the candor of his speech indicated the warmth of his attitude in friendship and the 'unwarmth' of his attitude in circumstances which betrayed a degree of enmity in others. But even when speaking of those whom he knew to be disciples of rancor the warmth of his nature invariably outwitted any feeling of recrimination that may have flitted across his mind: the dross was immediately submerged by the nobler metal."

"His many years of association with the medical department of the St. Louis University were a distinct asset to the university in those years of hard endeavor and high achievement. Together with other loyal and enthusiastic members of his profession he gave freely of his remarkable gifts and splendid attainments in order that the medical school might stand for what is best in a lofty profession."

"Perhaps the most prominent feature of Dr. Brown's character was its positive nature. He was a man of strong convictions and of equally strong prejudices. But to his credit be it said that he was always open and frank, never secretive or deceptive. His ideals of manhood were high and he could never stoop to meanness or perfidy. In his professional relations he was honorable and faithful in the discharge of duty. He aspired to high rank; his knowledge was thorough and accurate and his judgment good; his energy and enthusiasm never flagged."

"John Young Brown was a surgeon of large experience and unusual ability, but I like best to remember him as a man of courage and high integrity, as a companion who was witty and entertaining, and as a friend who was loyal and true."

"The death of Dr. John Young Brown, which so prematurely

terminated a useful life, is a great loss to me personally, as he was one of my closest friends and loyally supported my difficult work in Washington during the Great War."

"Dr. Brown was essentially a surgeon—a surgeon who dared and won. His courage was born of conviction. I think there were few of his day who equalled him in handling acute abdominal matters. Something in his temperament enabled him to cope with these crises while a long and fruitful experience rounded out his judgment. Thinking back over this man's life one can easily pick out his dominant characteristics—loyalty, honor, impulsiveness, love of right, devotion to principle, manliness and courage. There was not a spark of common spirit within him nor anything plebeian, but a great deal of the cavalier. John Young Brown was a born gentleman; he lived and died a gentleman."

"Dr. John Young Brown was more than a gifted surgeon; he was a scholar. He was more than a genius; he was a gentleman. He had more than the qualities of mind which bring professional success; he had the qualities of heart which brought many friends who truly mourn his untimely passing. There were combined in his character a considerable number of apparently opposite attributes. He was born in the purple, yet his strength was in his plebeian modesty. He was as handsome as a prince but he eschewed the looking-glass. He was a charming raconteur of the piquant but never inelegant story, yet he knew the classics as few others of our profession know them. He had the fighting blood of the cavalier but also the warm, loving heart of the southerner of gentle birth. He never forgot the graces and amenities. He had all the Chesterfieldian charm which could attach to a man of his brains. Dr. Brown was an ideal husband and father. When his mind was free of professional worry his thoughts reverted automatically to his family. To his wife he was a lover and to his children a constant, devoted companion."

"It is fitting that we should voice the void that all of us feel. For me, Dr. John Young Brown furnished a fillip that made life cheerier, happier and better. For fifteen years we were in almost daily contact, and it was one of those happiest of human contacts undisturbed even by occasional widely divergent differences of thought and opinion. I never knew him to hold a conviction that he felt was not worth fighting for. I never knew him to

have a conviction that was totally uncolored either by sentiment or by a saving grace of humor that kept him sweet. Thus do I think of him now, and his memory shall remain with me for all time as one of the worth-while possessions that have come to me in living."

"During the twenty years I was intimately associated with Dr. John Young Brown, being with him every day, working with him, listening to his advice and counsel, sharing with him many trying circumstances, never did I hear one harsh word pass his lips to any of his associates or those working with him. He had the enviable faculty of being able to put himself in the other man's place. It would be repetition to attempt to say anything more about him as a surgeon, for in his chosen specialty he reached the very heights; but he reached the heights also as a man and as a friend of all who knew and loved him."

"A closer insight into his personality teaches that he never forgot to inquire into the human side of all people he met. He had the unusual gift of being able to place himself almost at once in the other person's position. His big, comprehensive mind could quickly adapt itself to the narrower mentality of others. He could think their thoughts and feel their sensations. He had a perfect understanding of the viewpoints of others, and consequently drew and linked people to him by direct human appeal."

"Dr. Brown possessed to full measure the graces that go to make up a splendid manhood. He was kind, gentle and even-tempered. His sunny disposition made him always polite, agreeable and attractive. He was the very embodiment of good fellowship, no one could be in his company without receiving pleasure. He loved to hear good stories and could tell them himself with marked effect. His irrepressible sense of humor would often express itself in the sick-room, making the patient forget his suffering, and inspiring hope."

An apology for the length of this memorial rests upon the fact that there was no organization or body of men existing during his life to which he was drawn so closely and of which he was so proud as the Southern Surgical Association. We have lost a valuable Fellow and the profession a man of unusual attainments and lovable qualities, which will live long after his passing to brighten the path for all who knew him intimately.

FRED W. BAILEY.

JAMES A. GOGGANS, M.D.

1854–1920

Another Founder of the Association has passed to the Great Beyond. Doctor Goggans died at the home of his brother, in Alexander City, Ala., April 25, 1920, from carcinoma of the cecum. He was sixty-six years of age. His medical degree was received at the University of the City of New York in 1877.

A pioneer surgeon of Central Alabama, Dr. Goggans did remarkable work, even without the accommodation of a hospital. Postgraduate study, both in this country and abroad, enabled him to keep abreast of his time. His published papers included such subjects as "Surgery of Empyema," "Gunshot Wounds of the Abdomen" and "Hysterectomy for Fibroids." He had also been health officer of his county since 1877.

For many years Dr. Goggans had not attended a meeting of the Association. He was a Vice-President in 1898.

ISAAC L. WATKINS, M.D.

1854–1919

A LIFE of professional and civic usefulness was finished when Dr. Isaac Lafayette Watkins passed away on November 18, 1919, at his home in Montgomery, Alabama. He had been confined to the house for some time by an illness extending over many months, and had been unable to attend the April, 1919, meeting of his State Society, of which he was the president.

Dr. Watkins was born at Clayton, Alabama, in 1854. His professional education was thorough. He attended the best schools and clinics in this country and abroad. He was a Fellow of the American College of Surgeons, of the American Medical Association and of the Southern Surgical Association. The Highland Park Sanitarium, founded by Dr. Watkins, has had a successful existence of more than twenty-five years. On account of his failing health he found it necessary to limit his activities, and sold his interests in this institution six months before his death.

Dr. Watkins became a Fellow of this Association in 1898, at the Memphis meeting. He is remembered as a quiet, unassuming attendant on our sessions, a man of upright character and creditable attainments.

JOHN CHANDLER WYSOR, M.D.

1855–1919

Dr. John C. Wysor, one of our most valued Fellows, died at his home in Clifton Forge, Va., on February 23, 1919. A strong, rugged man, he succumbed to pneumonia after a few days' illness.

Dr. Wysor was sixty-four years of age and for many years had been chief surgeon of the Chesapeake and Ohio Railroad Hospital at Clifton Forge. Recently he was made consulting surgeon. He received his medical education at the College of Physicians and Surgeons, Baltimore, where he was graduated in 1878. He had been a Fellow of the Southern Surgical Association since 1900.

Many of our Fellows will recall pleasant association with Dr. Wysor—his sturdy character, his strong but conservative views and his attractive talent of story-telling.

STEWART WYLIE PRYOR, M.D.

1864–1918

Stewart Wylie Pryor was born in Spartanburg County, South Carolina, January 29, 1864. He received his preliminary education in rural schools and at a business college in Baltimore. He studied medicine under the preceptorship of a physician at Gaffney, S. C., and was graduated with honors at Atlanta Medical College in 1887, subsequently taking postgraduate courses at the New York Polyclinic Medical College.

He began the practice of his profession at Cherokee Springs, South Carolina, removing shortly thereafter to Lowryville, Chester County, South Carolina, but soon settled at Chester, South Carolina. At that time there were few skilled surgeons in the State, and those requiring operations were forced to seek attention at distant points. He built a combined hospital and residence, but was soon obliged, in 1904, to erect a large separate hospital, the Magdalene, which had every modern equipment. When it was destroyed by fire, in 1916, he built the Pryor Hospital, where he also maintained a charity ward and was never known to refuse relief to the suffering because of lack of funds.

He was president and surgeon of Pryor Hospital; chief surgeon to Carolina and Northwestern Railway Company and Lancaster and Chester Railway Company; consulting surgeon to Seaboard Air Line Railway and Chairman of Chester Board of Health. He was trustee of the Chester public schools, and as a member of the building committee was a dominant factor in erecting the Witherow School. He was one of Chester County's largest and most successful planters, owning and operating 2500 acres of land, and he was a factor in many business organizations and in real estate activities in and around Chester. He was a Fellow of the American College of Surgeons, the Medical Association, Southern Surgical Association and many other societies.

In all that he undertook he kept to the highest ideals of his profession and was an incessant worker. He had a lovable personality. He lent himself unstintedly to the works of the church, the school, the municipality, the State and to husbandry. His life was one of service. He was married in Union, South Carolina, February 14, 1888, to Carrie Magdalene, daughter of Rufus W. Tinsley, a Confederate veteran; she survives him, with seven children. He died at Chester, December 27, 1918. Doctor Pryor was elected a Fellow of this Association in 1916.

PROFESSOR POZZI

THE following letter, translation of a communication to the Secretary from Professor Hartmann, of Paris, is published here as a memorial to the late Professor Samuel Pozzi, a distinguished Honorary Fellow of this Association since 1894:

PARIS, FRANCE,
4, Place Malesherbes, XVII^{e}.

MY DEAR COLLEAGUE:

I thank you for sending me the TRANSACTIONS OF THE SOUTHERN SURGICAL ASSOCIATION, notice of which I shall have appear in the *Revue Gynecologie et Obstétrique*, which on the first of next January will combine the *Annales de Gynecologie* and the *Archives d'Obstétrique et de Gynecologie* into one journal. This will centralize all these publications in the French language.

I take advantage of this occasion to inform you that my colleague, Professor Pozzi, Honorary Fellow of your Association, died during the War. By reason of this his death may have escaped your notice.

Receive, I beg you, the expression of my best compliments.

HARTMANN.

17, 9th, 1919.

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